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ABSTRACT

The booklet is designed to assist teachers in improving locally developed classroom tests. It is a collection of 674 sample multiple-choice questions (with scoring keys) intended primarily for use as pretests, quizzes, or final examinations by secondary level teachers. The questions are organized around four industrial arts subject areas: drawing, electricity/electronics, power mechanics, and woods. The groups of questions are not meant to be complete examinations; rather, the items are offered as a resource, with selection and use to be determined by the teacher. (Author/PR)

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TEST DEVELOPMENT

RESOURCE ITEMS FOR

- DRAWING
- ELECTRICITY / ELECTRONICS
- POWER MECHANICS
- WOODS

CE 004 369

THE UNIVERSITY OF THE STATE OF NEW YORK / THE STATE EDUCATION DEPARTMENT
BUREAU OF ELEMENTARY AND SECONDARY EDUCATIONAL TESTING, ALBANY, NEW YORK 12224

1973

MAY 20 1975

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FOREWORD

Evaluation of knowledge and performance is an essential part of the teaching-learning process. While achievement may be measured in many ways, the teacher-written classroom test is the most commonly used evaluative instrument. Industrial Arts - Test Development is designed to assist teachers in improving locally developed classroom tests.

This collection of sample questions is intended primarily for use by secondary level teachers and is correlated with general program recommendations. The items may be used for pre-testing, quizzes, or for final examinations to assist in determining grade averages. As there are overlapping and similar items, the groups of questions do not represent a complete examination. The items are offered as a resource with selection and use to be determined by the teacher.

This publication was developed jointly by the Bureau of Elementary and Secondary Educational Testing and the Bureau of Industrial Arts. Mr. Kenneth Ormiston, Testing, and Mr. Jarvis Baillargeon, Industrial Arts, coordinated the publication. Industrial Arts teachers who served as item writers were: Paul Chapin, Deer Park; Hugh Craigie, Greece; George Fisher, Slate Hill; Ira Kahn, Bethpage; Kevin Kronau, Averill Park; Anthony Mangone, Hauppauge; Richard Talbot, Bohemia; and Thomas Weyand, Greece. The drawings were done by Katherine Casabella, Division of Educational Testing.

Arthur J. Dudley, Chief
Bureau of Industrial Arts
Education

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Industrial Arts Examination Materials

DRAWING

Directions (1-170): In the space provided write the number preceding the word or expression that, of those given, best completes the statement or answers the question.

Part I Developmental Drawing

Unit A. Preparation (1-24)

1 A drafting machine can do the same jobs as a

(1) T-square, triangle, compass, and protractor
(2) triangle, compass, protractor, and scale
(3) scale, protractor, T-square, and compass
(4) T-square, triangle, scale, and protractor 1 _____

2 Which tool is used to draw quickly such items as boltheads, nuts, and electrical and architectural symbols?

1 template
2 protractor
3 beam compass
4 triangular scale 2 _____

3 Which tool should be used to draw a curved line that does not have a radius?

1 compass
2 beam compass
3 bow pencil
4 French curve 3 _____

4 A draftsman would use a micrometer caliper to

1 draw several views of an object
2 eye up an object for a three-view drawing
3 make accurate measurements
4 construct circles and arcs 4 _____

5 Which drafting tool is used to draw circles and arcs which have a center point?

1 scale
2 compass
3 divider
4 protractor 5 _____

6 An eraser shield is mainly used to

1 keep an eraser clean
2 allow erasure of part of a line
3 keep drawings clean
4 measure eraser marks

6 _____

7 When a draftsman is drawing a true horizontal line, the pencil point should be guided by a

(1) T-square
(2) triangle
(3) scale
(4) compass

7 _____

8 Which edge of a drawing board is the head of a T-square usually placed flush against?

1 right
2 left
3 top
4 bottom

8 _____

9 Reproductions of drawings are usually made from

1 inking done on buff paper
2 blueprints
3 pencil drawings on white paper
4 pencil drawings on vellum paper

9 _____

10 Arrowheads are usually found at both ends of

1 extension lines
2 cutting plane lines
3 centerlines
4 object lines

10 _____

11 The lines given in the American standards for use in the making of a drawing are known as the

1 conventional line symbols
2 alphabet of lines
3 national line chart
4 symbols of line

11 _____

12 The lines that are drawn lightly at the top and bottom of each line of letters are called

1 construction lines
2 object lines
3 guidelines
4 extension lines

12 _____

13 How far should extension lines continue beyond the arrowheads?

(1) $\frac{1}{8}$ in.
(2) $\frac{1}{4}$ in.
(3) $\frac{3}{8}$ in.
(4) $\frac{1}{2}$ in.

13 _____

14 The size of an object is given between the

1 centerlines
2 dimension lines
3 extension lines
4 object lines

14 _____

15 Which line is the darkest on an orthographic drawing?

1 hidden
2 center
3 section
4 object

15 _____

16 Which type of lettering should be used in mechanical drawing?

1 uppercase, only
2 lowercase, only
3 both upper- and lowercase
4 neither upper- nor lowercase

16 _____

17 Which of the following is an obtuse angle?

(1) 60°
(2) 90°
(3) 110°
(4) 250°

17 _____

18 The distance around a circle is called the

1 radius
2 arc
3 diameter
4 circumference

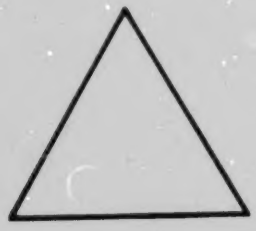
18 _____

19 How much overlapping should there be when using a French curve?

(1) $\frac{1}{16}$ in.
(2) $\frac{1}{8}$ in.
(3) $\frac{1}{4}$ in.
(4) $\frac{1}{2}$ in.

19 _____

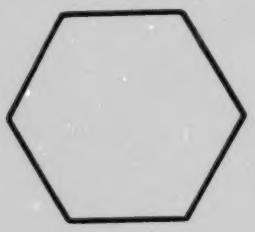
20 What type of triangle is shown below?



1 scalene
2 isosceles
3 equilateral
4 right

20 _____

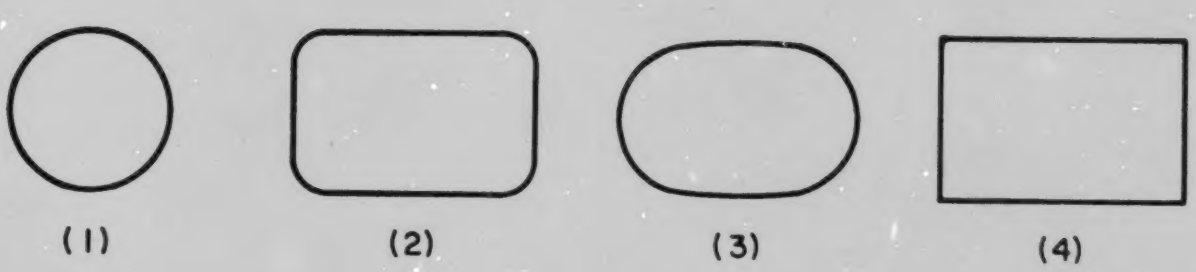
21 What type of geometric figure is shown below?



1 a hexagon
2 an octagon
3 a square
4 a triangle

21 _____

22 Which diagram best represents a super-ellipse?



22 _____

23 The standard form of lettering on working drawings is single stroke

1 commercial gothic
2 roman
3 italic
4 Bodoni

23 _____

24 The arrangement and spacing of words and lines with letters of appropriate style and size are called

1 universal layout
2 letter construction
3 mechanical lettering
4 composition

24 _____

Unit B. Sketching (25-48)

25 When one face of an object is parallel to the front plane, the horizontal lines on the face do not have a vanishing point. Which type of perspective is used in this drawing?

1 one-point
2 two-point
3 three-point
4 overlapping

25 _____

26 How many faces are shown by a pictorial drawing?

(1) 1
(2) 2
(3) 3
(4) 4

26 _____

27 Which type of drawing is most often used as a pictorial sketch?

1 geometrical
2 auxiliary
3 orthographic
4 isometric

27 _____

28 How far apart are the axes in an isometric drawing?

(1) 60°
(2) 90°
(3) 120°
(4) 180°

28 _____

29 Isometric sketches are built on a skeleton of the three lines representing the three edges of a cube. These three lines form equal angles of

(1) 30°
(2) 60°
(3) 120°
(4) 360°

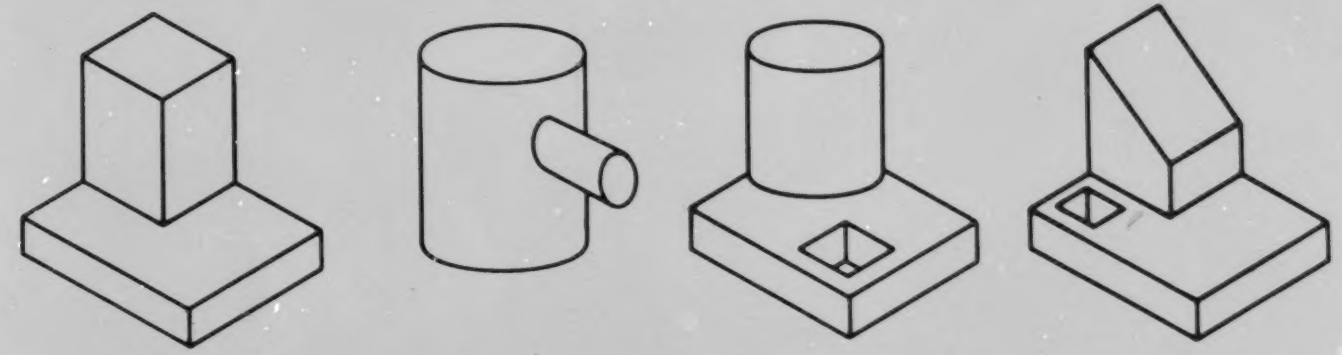
29 _____

30 On an isometric sketch, circles and arcs will appear as

1 straight lines
2 round, smooth lines
3 ellipses or parts of ellipses
4 round arcs without any distortions

30 _____

31 Which drawing contains nonisometric lines?



(1) (2) (3) (4)

31 _____

32 The first step in drawing an isometric circle is to

1 plot the circle on graph paper
2 draw an isometric square
3 lay out nonisometric lines
4 set the compass at the required radius to swing the circle

32 _____

33 When the angle of the oblique projectors is 45°, the projection being formed is called

1 an axonometric projection
2 a cavalier projection
3 a cabinet projection
4 a dimetric projection

33 _____

34 In a perspective sketch of an object, the two sets of horizontal lines each converge toward a point on the horizon line. This point is called the

1 vanishing point
2 object point
3 horizon point
4 nonparallel point

34 _____

35 Which type of drawing shows one surface of the object without distortion?

1 isometric
2 perspective
3 exploded
4 oblique

35 _____

36 In a section of a drawing, the cutting plane changes direction to show a detail. This section of the drawing is called

1 a full section
2 a half section
3 a quarter section
4 an offset section

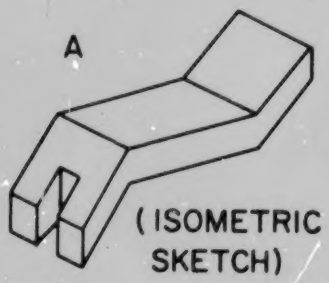
36 _____

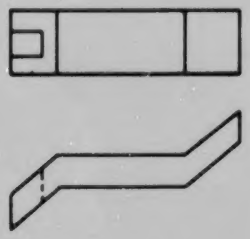
37 An auxiliary drawing shows the true shape of

1 a round surface
2 an inclined surface
3 a flat surface
4 a rough surface

37 _____

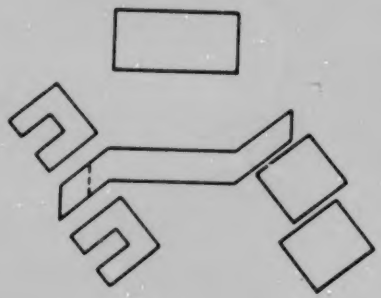
38 Which is the correct auxiliary view of object A shown below?





(1)

(3)



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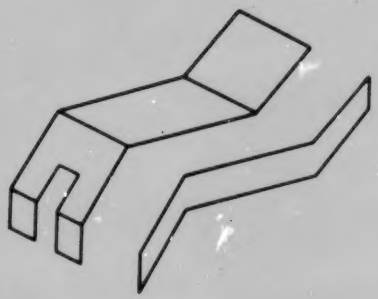


(4)

38 _____

39 Elevation auxiliary views are made on planes that are perpendicular to the

1 frontal plane
2 profile plane
3 reference plane
4 horizontal plane

39 _____

40 An auxiliary view should only be used when

1 there is more than one view being drawn
2 a rough isometric sketch of the object is being drawn
3 the usual views of an object do not show the true shape of the slanted surface
4 there are two or more hidden lines in the orthographic projection drawing

40 _____

41 In which type of view is the plane of projection parallel to a slanted surface and the viewer perpendicular to the slanted surface?

1 frontal
2 auxiliary
3 related
4 sectional

41 _____

42 What must be found before the true shape of a plane in an auxiliary drawing can be determined?

1 the true length of each line
2 the true size of each angle
3 the profile view of the object
4 the edge view of the plane

42 _____

43 Which view is perpendicular to the front vertical plane and inclined to the horizontal and profile plane?

1 an inclined plane view
2 a horizontal plane view
3 an auxiliary plane view
4 a frontal plane view

43 _____

44 Which view would show an object as if it were cut apart exposing many inside details?

1 auxiliary
2 frontal
3 sectional
4 exploded

44 _____

45 How much of the object is cut away in a half-section drawing?

1 one-quarter
2 one-third
3 one-half
4 three-quarters

45 _____

46 Hidden lines are not shown in a sectional view unless they are needed for

1 dimensioning
2 more detail
3 section lining
4 symmetrical shapes

46 _____

47 Which view is used to show how an object is assembled?

1 isometric
2 exploded
3 sectional
4 perspective

47 _____

48 Section lines are drawn at an angle of

(1) 30° to the horizontal
(2) 45° to the horizontal
(3) 60° to the horizontal
(4) 90° to the horizontal

48 _____

Unit C. Working Drawing (49-72)

49 The parts of an object which actually cannot be seen are represented by

1 object lines
2 section lines
3 hidden lines
4 centerlines

49 _____

50 How many views are needed to define cylindrical objects in orthographic drawings?

(1) 1
(2) 2
(3) 3
(4) 4

50 _____

51 Which projection shows the same view as an orthographic projection?

1 right angle
2 isometric
3 oblique
4 auxiliary

51 _____

52 An orthographic drawing should always be started by drawing the

1 dimension lines
2 lines between the different views
3 front view
4 extension lines

52 _____

53 The box usually located in the lower right-hand corner of a drawing, which gives such information as the scale, date, name of the job, and company, is called the

1 bill of material block
2 notes detail block
3 title block
4 limit dimensions block

53 _____

54 If two circles are concentric, then they must

1 be the same size
2 be different sizes
3 have different centers
4 have the same center

54 _____

55 In which two views is the overall depth of an object shown?

1 end and top views
2 end and front views
3 front and top views
4 front and back views

55 _____

56 The space or opening between two straight lines which meet is called

1 a circle
2 a bisect
3 a triangle
4 an angle

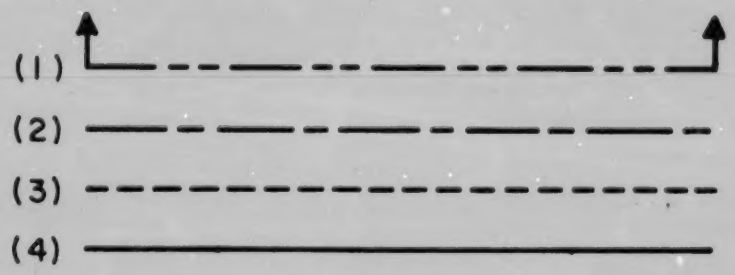
56 _____

57 How long should the dashes of a hidden line be?

(1) $\frac{1}{32}$ in.
(2) $\frac{1}{8}$ in.
(3) $\frac{1}{4}$ in.
(4) $\frac{1}{2}$ in.

57 _____

58 Which line below is a cutting plane line symbol?



58 _____

59 How far apart are dimension lines usually spaced?

(1) $\frac{1}{8}$ in. (3) $\frac{1}{2}$ in.

(2) $\frac{3}{8}$ in. (4) $\frac{3}{4}$ in. 59 _____

60 What is the total number of different compass centers used when mechanically drawing the ellipses in an isometric drawing?

(1) 5 (3) 3

(2) 2 (4) 4 60 _____

61 Which view is shown by a vertical projection?

1 top 3 front
2 end 4 bottom 61 _____

62 Which are the two groups into which working drawings are divided?

1 architecture and pattern drawings
2 assembly and detail drawings
3 detail and auxiliary drawings
4 section and isometric drawings 62 _____

63 In shape description, centerlines are used to

1 locate views and dimensions
2 determine the height of letters
3 construct a base line perpendicular to a slanted surface
4 locate hidden object lines 63 _____

64 The Pythagorean theorem can be used to determine the

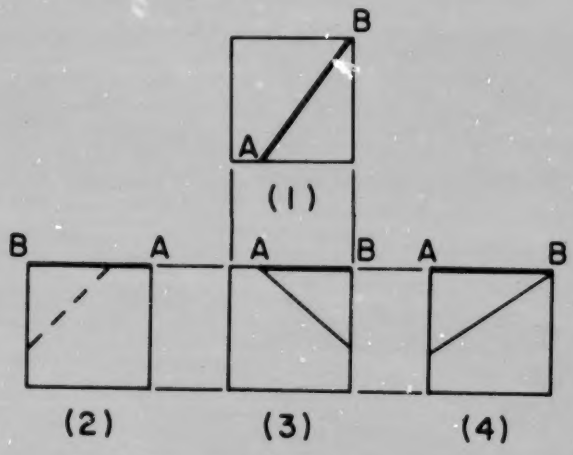
1 height of a building
2 area of a floor
3 squareness of building corners
4 distance from the ground to a proposed floorline 64 _____

65 Which is one of the rules of revolution?

1 The views of the front, top, and side remain unchanged.
2 Distances parallel to the axis of revolution are unchanged.
3 The true length of a line remains unchanged in any position.
4 The angle of the object in the top and front views remains unchanged.

65 _____

66 Four views of line AB are shown below. Which view shows the true length of line AB?



66 _____

67 A line should be shown in true length when it

1 is perpendicular to the line of sight
2 is parallel to the line of sight
3 appears shorter in the orthographic projection
4 visually becomes a point

67 _____

68 Which term describes the direction or course of a line on the earth's surface?

1 slope
2 bearing
3 grade
4 horizontal run

68 _____

69 In geometry construction, the principal lines are lines that are

1 parallel to the oblique plane of projection
2 parallel to the horizontal plane of projection
3 perpendicular to the frontal plane of projection
4 perpendicular to the profile plane of projection 69 _____

70 What is the name of the system of vectors whose lines of action pass through a common point?

1 component system
2 coplanar system
3 concurrent system
4 noncoplanar system 70 _____

71 Which lines are drawn between the views of descriptive geometry constructions and represent the intersection of the projection planes?

1 view lines
2 object lines
3 folding lines
4 lines of sight 71 _____

72 Bend lines are indicated on a surface pattern by

(1) dotted lines
(2) heavy lines
(3) O's
(4) X's 72 _____

Unit D. Charts, Graphs, Maps (73-78)

73 Flow charts may be used to show

1 a comparison of aircraft characteristics
2 position of personnel in an organization
3 the sequence or order of operations
4 the area of each room in a building 73 _____

74 Which type of bar graph compares several items of information in the same graph?

1 line
2 area
3 percent
4 composite 74 _____

75 Area graphs are sometimes called

1 bar graphs
2 pictorial graphs
3 pie graphs
4 line graphs

75 _____

76 Two types of graphs used in industrial drafting are

1 line and bar
2 bar and organizational
3 flow and line
4 flow and organizational

76 _____

77 All of the lines on a line graph are called

1 a grid
2 a variable
3 a constant
4 an abscissa

77 _____

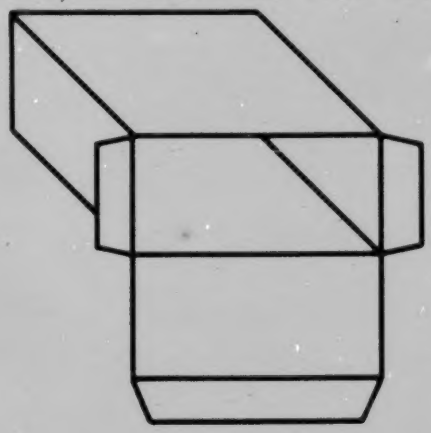
78 The horizontal lines of a line graph are called the

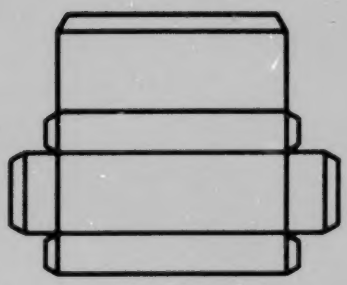
1 ordinate
2 abscissa
3 axis
4 variables

78 _____

Unit E. Flat Developments (79-90)

79 Which drawing shows how the cardboard box below would look if it were completely unfolded and laid flat?





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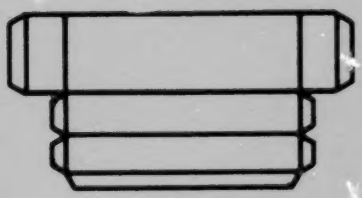

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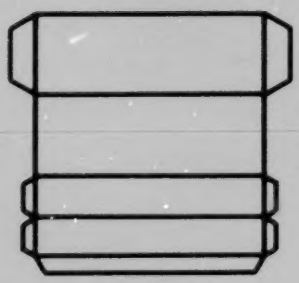

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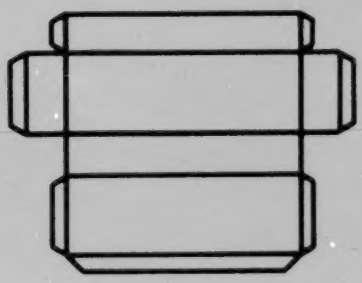

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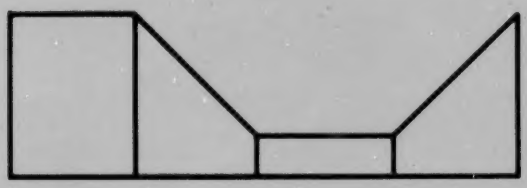
79 _____

80 Which of the surface patterns below could be folded to form a truncated square?



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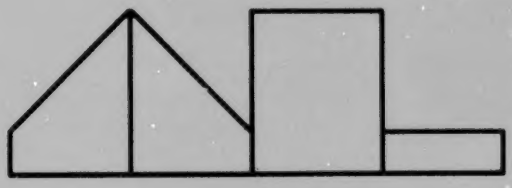

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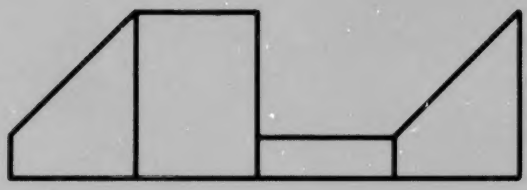


(2)

(4)

80 _____

81 In sheetmetal articles, seams and laps are used to

1 indicate the edges
2 join the edges
3 reinforce the edges
4 eliminate waste on the edges

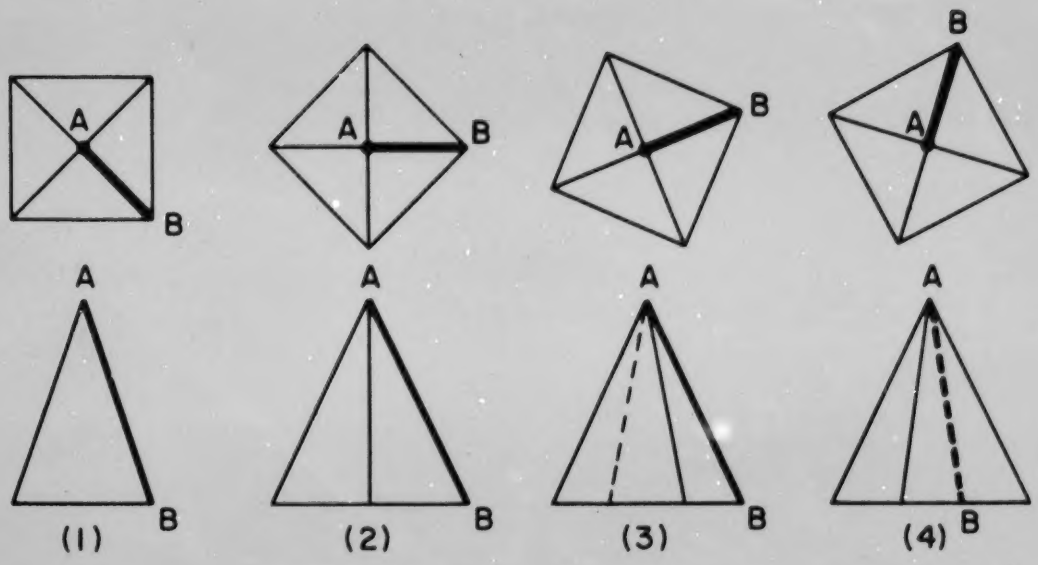
81 _____

82 The stretchout developments for sheetmetal products are drawn

1 one-eighth size
2 one-fourth size
3 one-half size
4 full size

82 _____

83 Which drawing has a true length line?



83 _____

84 Which type of development is used to make patterns for prisms and cylinders?

1 parallel line
2 perpendicular line
3 intersecting line
4 converging line

84 _____

85 Which tool is used when drawing an irregular curve on a surface development?

1 compass
2 French curve
3 bow pen
4 isometric template

85 _____

86 In sheetmetal, a pattern is called

1 a pictorial drawing
2 a multiview drawing
3 a stretchout drawing
4 an exploded drawing

86 _____

87 Patterns for regular tapering forms such as cones and pyramids are developed by

1 radial lines
2 curved lines
3 section lines
4 extension lines

87 _____

88 In pattern developments, the lines shown inside the pattern are called

1 extension lines
2 radial lines
3 guidelines
4 folding lines

88 _____

89 Dotted lines on pattern developments indicate

1 extra material to allow for laps in making joints
2 the areas that cannot be seen from that view
3 where the material is to be cut
4 where the material is to be creased

89 _____

90 Whenever two or more surfaces come together, there is a line common to both that is called the

1 crease line
2 hidden line
3 true length line
4 intersecting line

90 _____

Unit F. Construction (91-105)

91 If an estimate shows a house will cost $18.00 per square foot, what will be the cost of a house 20 feet by 40 feet?

(1) $12,600
(2) $14,200
(3) $14,400
(4) $15,400

91 _____

92 Which of the following must be done before a topographic map of an area can be made?

1 title search
2 plot plan
3 profile plans
4 survey (field)

92 _____

93 On a topographic map, a series of points at a selected elevation may be connected with

1 a profile line
2 a grid line
3 a contour line
4 an outcrop line

93 _____

94 Which type of drawing shows the vertical height above sea level and the horizontal distance along a section line?

1 detail
2 profile
3 geodetic
4 geographic

94 _____

95 Which type of pictorial sketch is used mostly in architectural drawing?

1 isometric
2 oblique
3 cabinet
4 perspective

95 _____

96 Contour lines are used on maps to show how the

1 vertical distance of ground levels above or below sea level
2 different counties and townships on local maps
3 boundaries of a tract of land
4 streams, lakes, and coastlines of a country

96 _____

97 Which type of map includes such information as boundaries, natural features, the works of man, vegetation, and relief elevations and depressions?

1 survey map
2 city map
3 topographic map
4 roadmap

97 _____

98 A map that records the boundaries and identifies a tract of land is called a

1 contour plan
2 topographic map
3 plot plan
4 profile map

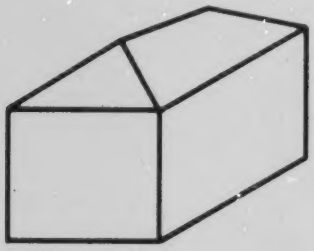
98 _____

99 Preliminary drawings of a proposed building often include plans, elevations, and perspective drawings, but do not include working information. Drawings of this type are called

1 working drawings
2 detail drawings
3 sketches
4 competitive drawings

99 _____

100 Which type of roof is shown below?



1 gable
2 shed
3 flat
4 hip

100 _____

101 Which type of drawing shows the front, side, and back views of a building?

1 perspective
2 detail
3 elevation
4 floor plan

101 _____

102 The vertical post between windows is called a

1 windowpane
2 bar
3 parting strip
4 mullion

102 _____

103 The actual size of a 2-by-4 is

(1) $1\frac{1}{2}$ in. × $3\frac{3}{4}$ in.
(2) $1\frac{1}{2}$ in. × $3\frac{1}{2}$ in.
(3) $2\frac{1}{4}$ in. × $4\frac{1}{4}$ in.
(4) $1\frac{5}{8}$ in. × $3\frac{5}{8}$ in.

103 _____

104 When conventional studding for a frame house is to be covered with insulation board, the studs should be spaced

(1) 12 inches o.c.
(2) 16 inches o.c.
(3) 24 inches o.c.
(4) 36 inches o.c.

104 _____

105 The standard nominal size of a concrete block is

(1) 4 in. × 6 in. × 16 in.
(2) 6 in. × 6 in. × 12 in.
(3) 6 in. × 6 in. × 16 in.
(4) 8 in. × 8 in. × 16 in. 105 _____

Unit G. Careers (106-112)

106 Who gathers the field notes that are used by a map draftsman?

1 civil engineer
2 architect
3 construction worker
4 surveyor 106 _____

107 In the field of drafting, a person with only high school training usually starts as a

1 draftsman
2 checker
3 tracer
4 designer 107 _____

108 Which person has the job of simplifying and improving the operation and appearance of industrial products?

1 designer
2 chief draftsman
3 model maker
4 illustrator 108 _____

109 Which subject would be most helpful to a tool designer?

1 art
2 chemistry
3 music
4 trigonometry 109 _____

110 The person responsible for the work of the drafting department is the

1 senior draftsman
2 chief draftsman
3 junior draftsman
4 draftsman-in-training 110 _____

111 Upon completion of the training period, a trainee draftsman should advance to a

1 designer
2 checker
3 senior draftsman
4 junior draftsman

111 _____

112 Which person plans and designs all types of structures and buildings?

1 designer
2 architect
3 model maker
4 technical illustrator

112 _____

Part II

Production Drawing

Unit A. Sketching (113-118)

113 The first working model of a product is called a

1 prototype
2 detail
3 drift
4 thumbnail sketch

113 _____

114 In which type of pictorial sketch is the object placed with one surface parallel to the frontal plane?

1 isometric
2 sectional
3 perspective
4 oblique

114 _____

115 An object in the exploded view is

1 cut in half
2 separated into its individual parts
3 drawn flat so that the true dimensions can be seen
4 turned at a 30° angle to the baseline

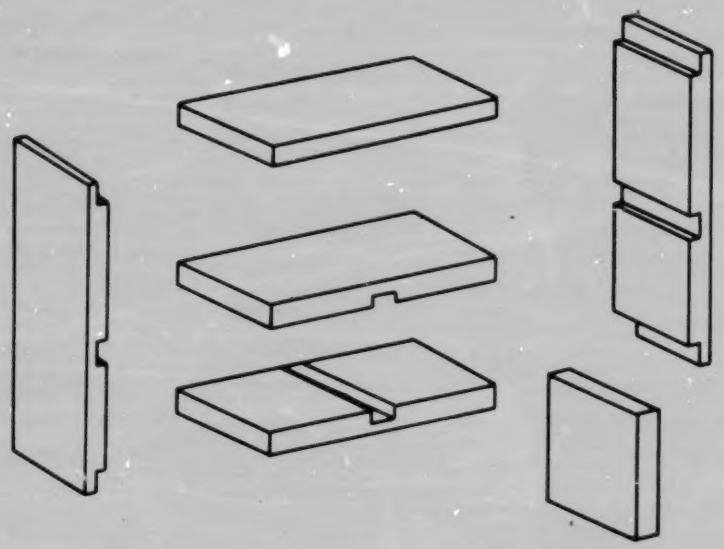
115 _____

116 Which type of sketch is helpful in reading orthographic views?

1 isometric
2 auxiliary
3 elevation
4 schematic

116 _____

117 Which type of production sketch is shown below?



1 two-point perspective
2 section
3 exploded
4 orthographic projection

117 _____

118 Which type of paper is used for scale proportion in making production sketches?

1 graph
2 opaque
3 tracing
4 linen

118 _____

Unit B. Jigs and Fixtures (119-121)

119 What is the difference between a jig and a fixture?

1 A jig is free to move, and a fixture is fixed in a definite position.
2 A jig is used on rough surfaces and a fixture is used on smooth surfaces.
3 A jig is used for drilling, boring, and reaming only, and a fixture is used for countersinking and counterboring.
4 A jig is made of wood and a fixture is made of metal.

119 _____

120 Which device locates and holds a production part, and guides the cutting tools during the machining operation?

1 bushing
2 jig
3 punch
4 plug

120 _____

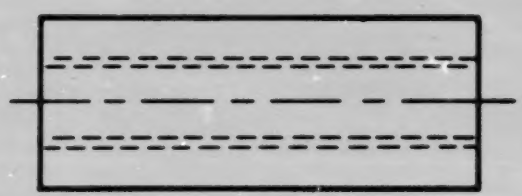
121 Which is a simple milling fixture?

1 socket
2 block
3 bushing
4 machine vise

121 _____

Unit C. Fasteners (122-129)

122 What type of screw thread representation is shown below?



1 common
2 simplified
3 profile
4 conventional

122 _____

123 On what diameter rod is a $\frac{1}{2}$-inch-diameter thread cut?

(1) $\frac{3}{8}$ in. (3) $\frac{1}{2}$ in.

(2) $\frac{7}{16}$ in. (4) $\frac{9}{16}$ in. 123 _____

124 Which tool is used to cut an internal thread?

1 tap 3 vise
2 die 4 tap drill 124 _____

125 At what angle is the American national thread profile drawn?

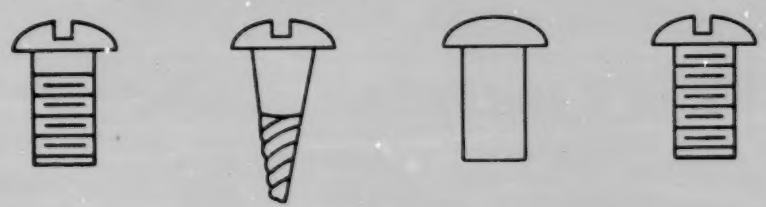
(1) 30° (3) 60°

(2) 45° (4) 90° 125 _____

126 Which type of thread on a screw is designed to transmit motion or power and to hold all forces in line with the axis?

1 knuckle 3 sharp V
2 worm 4 buttress 126 _____

127 Which is a fastener used to hold sheetmetal plates and structural steel shapes together?



(1) (2) (3) (4)

127 _____

128 Which type of screw is used to fasten two pieces together by passing the screw through a hole in one plate and screwing it into a tapped hole in the other?

1 machine
2 cap
3 set
4 wood

128 _____

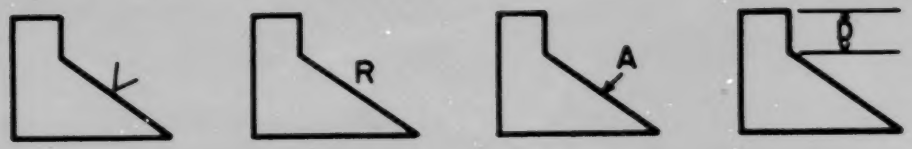
129 When permanent fastenings are required, sheetmetal plates and structural steel shapes are usually fastened together with

1 locknuts
2 setscrews
3 stud bolts
4 rivets

129 _____

Unit D. Machine Parts (130-138)

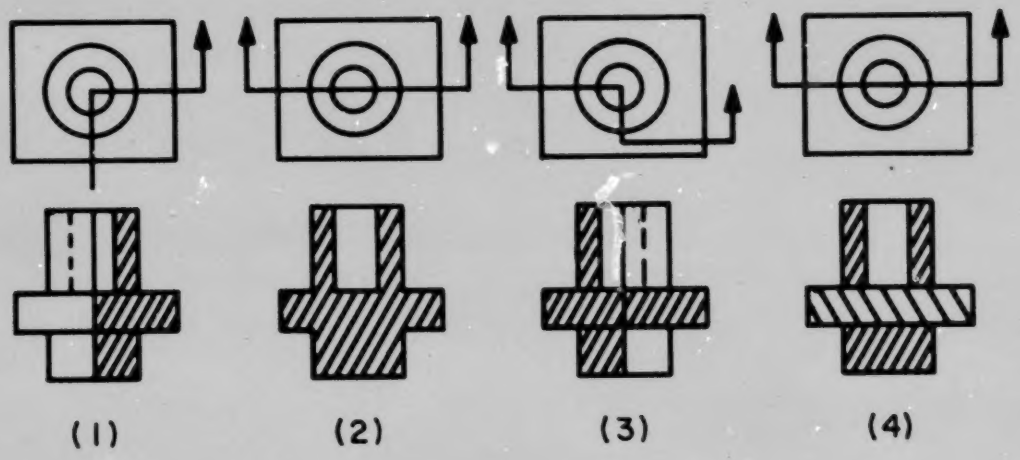
130 Which symbol is used to indicate finished or machined surfaces?



(1) (2) (3) (4)

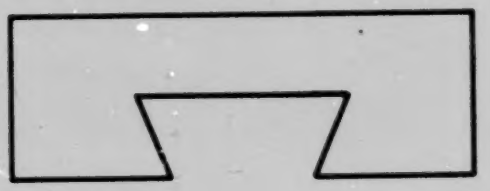
130 _____

131 Which drawing shows a section of pieces assembled?



131 _____

132 What does the diagram below represent?



(1) T-slot
(2) keyway
(3) dovetail
(4) chamfer

132 _____

133 Which type of section shows the true size and shape of spokes, arms, ribs, bars, and other elongated parts?

1 a removed section
2 an assembly section
3 a broken-out section
4 an aligned section 133 _____

134 What should be the size of the keyway for a $\frac{1}{4}$-inch-×-$\frac{1}{4}$-inch key?

(1) $\frac{1}{4}$ inch × $\frac{1}{16}$ inch (3) $\frac{1}{2}$ inch × $\frac{1}{4}$ inch

(2) $\frac{1}{4}$ inch × $\frac{1}{8}$ inch (4) $\frac{1}{2}$ inch × $\frac{1}{2}$ inch 134 _____

135 What is the noncircular raised portion above the surface of a casting called?

1 boss 3 chamfer
2 fillet 4 pad 135 _____

136 A casting is to be finished all over. The drawing can be simplified by omitting the finish marks and adding the abbreviation

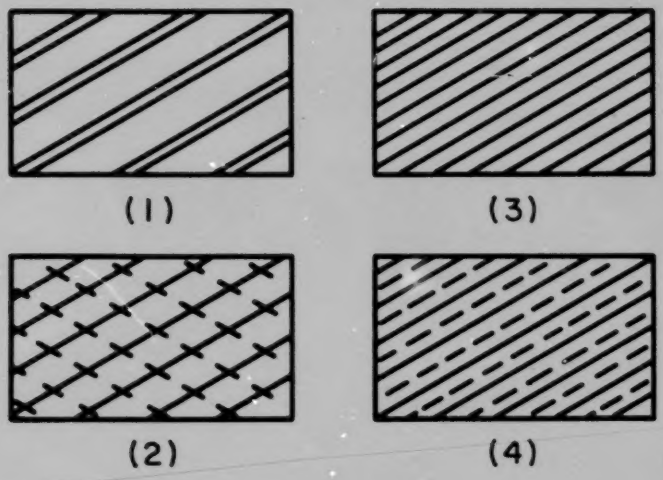
(1) a.s.a. (3) f.a.o.

(2) s.a.e. (4) f.o.a. 136 _____

137 Which tool should be used to machine a drilled hole accurately to an exact size?

1 counterbore 3 reamer
2 tap drill 4 flute cutter 137 _____

138 Which drawing shows the symbol for aluminum when shown in section?



138 _____

Unit E. Assemblies (139-145)

139 Which type of drawing contains notes about the kind of material, the kind of fit, and the methods of machining?

1 working
2 thumbnail
3 oblique
4 perspective

139 _____

140 Which type of drawing shows a completed object as it really appears?

1 assembly drawing
2 elevation drawing
3 detail drawing
4 schematic drawing

140 _____

141 A complete drawing of a single part of an object is called a

1 machine detail drawing
2 parting line drawing
3 casting detail drawing
4 detail drawing

141 _____

142 Exploded drawings show each part of an assembly drawn separately and in a position that shows how the parts

1 fit together
2 are labeled
3 are made
4 are machined

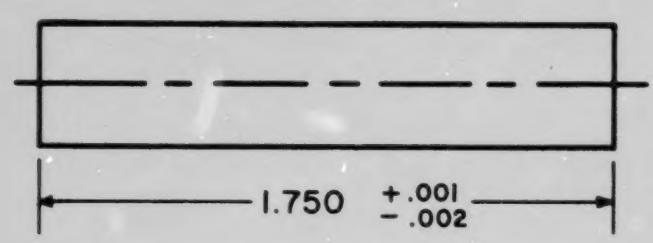
142 _____

143 In order to remove a pattern from a sand mold, the side must have a slight taper called a

1 die
2 draft
3 shrinkage
4 radii

143 _____

144 What is the maximum length of the shaft shcwn below?



(1) 1.748
(2) 1.750
(3) 1.751
(4) 1.753

144 _____

145 How are the dimensions for fillets and rounds given?

1 as a radius
2 as a diameter
3 in degrees
4 as whole numbers

145 _____

Unit F. Power Transmission (146-156)

146 What part of a cam does the follower move along as a cam rotates?

1 face
2 keyway
3 base circle
4 center

146 _____

147 A cam displacement diagram shows the profile of a cam over one revolution or

(1) 45°
(2) 90°
(3) 180°
(4) 360°

147 _____

148 What kind of motion is produced by a cam?

1 quiet
2 still
3 flat
4 irregular

148 _____

149 When a cam's motion does not rise or fall, the motion is called

1 displacing
2 dwelling
3 knurling
4 parabolic

149 _____

150 Which type of gear is used to transmit power between two shafts whose axes intersect?

1 spur
2 worm
3 bevel
4 skew

150 _____

151 The major diameter of a gear tooth is called the

1 pitch circle
2 root circle
3 addendum circle
4 base circle

151 _____

152 Rotating and reciprocating motions are transmitted from one machine part to another by

1 an axis
2 a gear
3 a condenser
4 an intersection

152 _____

153 One gear has half as many teeth as a larger gear. What is the gearing ratio of the two gears?

(1) 1:1 (3) 3:4

(2) 2:1 (4) 2:3 153 _____

154 A spur gear meshed with a rack gear will convert rotary motion to

1 reciprocating motion 3 circular motion
2 up-and-down motion 4 worm motion 154 _____

155 The distance that a thread advances axially in one turn is called the

1 clearance 3 pitch
2 dedendum 4 lead 155 _____

156 What is the maximum number of centers needed to draw a chain link?

(1) 1 (3) 3

(2) 2 (4) 4 156 _____

Unit G. Manufacturing (157-167)

157 Mass production was made possible by

1 cheap labor
2 cheap material
3 interchangeable parts
4 good working conditions 157 _____

158 The aligned system is a system of

1 lettering 3 dimensioning
2 projection 4 drilling 158 _____

159 The thickness tolerance of a part refers to the part's overall

1 height
2 length
3 width
4 weight

159 _____

160 Which instrument can make measurements to .001 in.?

1 combination square
2 vernier caliper
3 micrometer caliper
4 fixed gauge

160 _____

161 When designing a new product, which type of drawing is usually made first?

1 flow chart
2 sketch solution
3 detail drawing
4 engineering drawing

161 _____

162 In any well-designed product, which factor is most important?

1 line
2 form
3 function
4 principle

162 _____

163 In the Golden Rectangle, the ratio of length to width is

(1) 1:1
(2) 1:1.6
(3) 1:2
(4) 1:3

163 _____

164 Which two aspects of design are most important in designing a chair?

1 proportion and balance
2 unity and color
3 rhythm and texture
4 texture and color

164 _____

165 When designing consumer products, which factor is most important?

1 appearance
2 maintenance
3 utility
4 sales appeal

165 _____

166 Once the function of a product has been defined, the next step in the design process is

1 making a drawing that shows the appearance of the product
2 determining the materials and construction processes needed to make the product
3 making a working model of the product
4 planning a sales campaign to promote the product 166 _____

167 The international system of measurement is referred to as S.I. This system is commonly called the

(1) standard system (3) A.S.A. system
(2) customary system (4) metric system 167 _____

Unit H. Production Personnel (168-170)

168 Which type of drawing does a technical illustrator usually make?

1 three-dimensional 3 sheetmetal
2 schematic 4 working 168 _____

169 The term civil engineering refers to the planning and construction of

1 rockets, missiles, and spacecraft
2 computers and control instruments
3 tools and machines
4 highways, bridges, and dams 169 _____

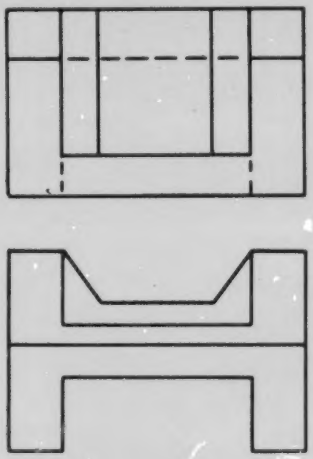
170 In order for an architect to receive a license to practice, he must pass a

1 state examination 3 federal examination
2 local examination 4 county examination 170 _____

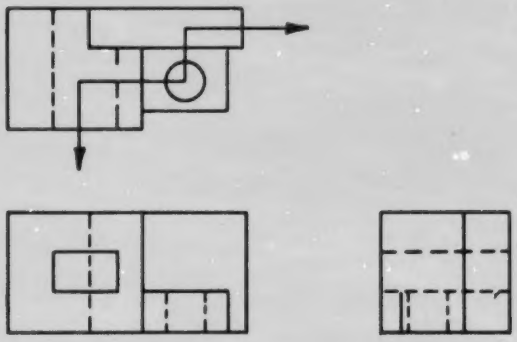
Group Questions (171-187)

171 a In the space provided, draw a freehand isometric sketch of the object shown below. [4]

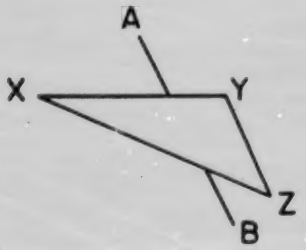
b In the space provided, complete the profile view of the object shown below. [1]

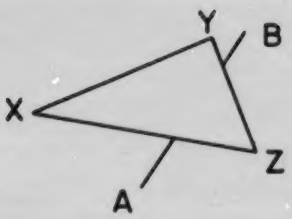


172 In the space provided, sketch the isometric section of the object shown below. [5]

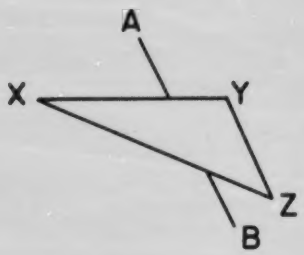


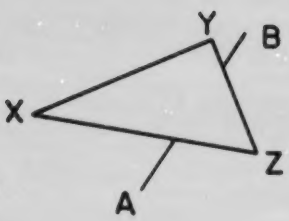
173 a On the diagram below, draw the intersection of line AB and plane XYZ using the auxiliary method. [3]





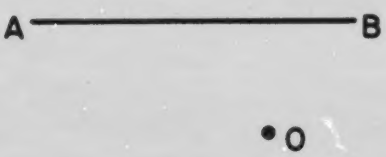
b On the diagram below, draw the intersection of line AB and plane XYZ using the two-view method. [2]





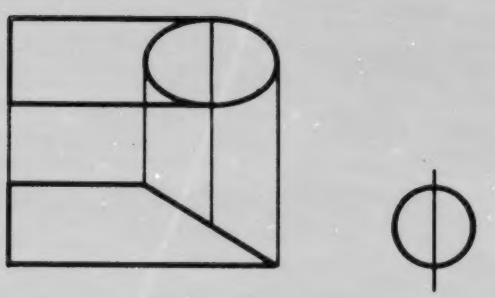
174 Bisect line AB using only a compass. [5]

175 Using a compass, erect a perpendicular to the given line AB from point O outside the line. [5]

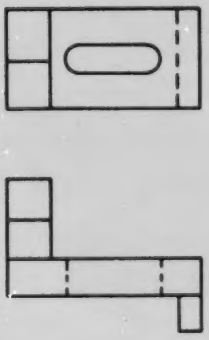


L.6.

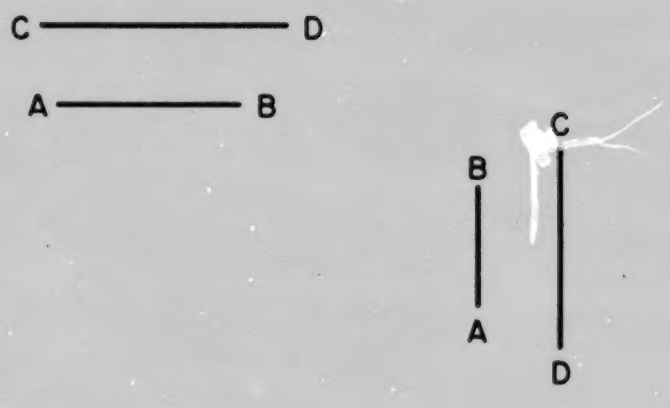
176 Sketch in the auxiliary view of the cut face of the cylinder shown below. [5]



177 Complete the side view of the diagram below. [5]



178 Complete the sketch of parallel lines AB and CD in the frontal view. [5]

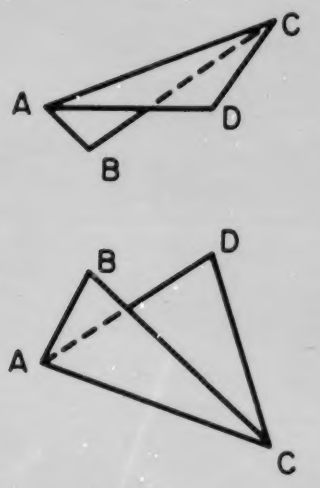


179 Construct a hexagon using only a protractor, a compass, and triangles. [5]

180 Construct an isometric circle using only a triangle, a compass, and a T-square. [5]

181 Divide the given line AB into five equal parts using the parallel line method. [5]

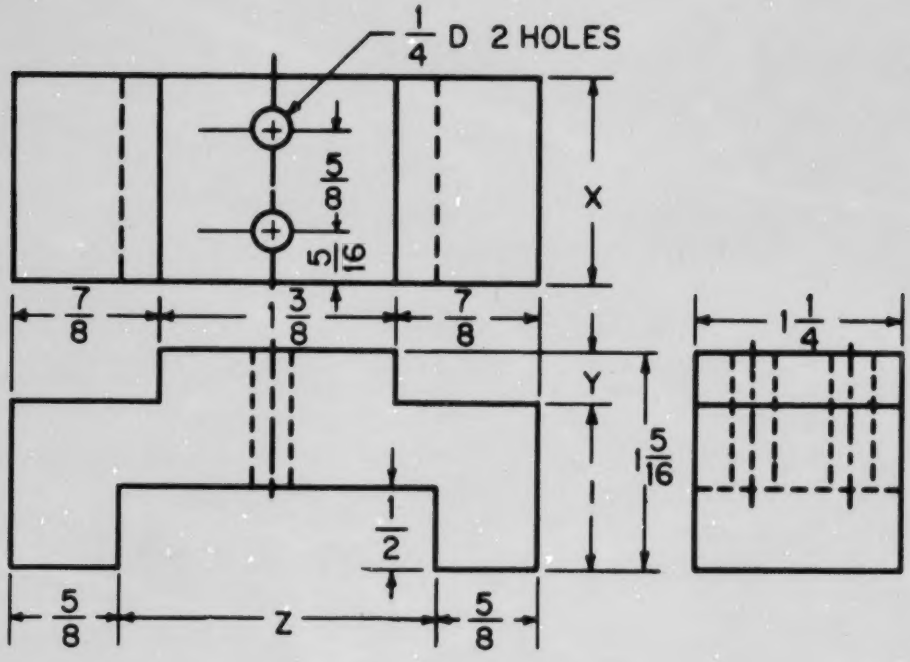
182 Complete the visibility of the two planes that have line AC in common. Use the two-view method. [5]



183 Draw and indicate the magnitude of the resultant of coplanar vectors A, B, C, D, and E. [Scale 1 inch = 20 lb.] [5]

A	220°	20 lb.	(force)
B	170°	30 lb.	
C	150°	10 lb.	
D	125°	30 lb.	
E	90°	10 lb.	

184 Base your answers to parts a through e on the drawing shown below. [5]



a What is the size of dimension X?

(1) $1\frac{1}{16}$ in. (3) $1\frac{1}{4}$ in.

(2) $1\frac{1}{2}$ in. (4) $1\frac{3}{4}$ in.

a _____

b What is the size of dimension Y?

(1) $\frac{5}{16}$ in. (3) $\frac{3}{16}$ in.

(2) $\frac{5}{8}$ in. (4) $\frac{1}{4}$ in.

b _____

c What is the center-to-center dimension of the holes?

(1) $\frac{5}{16}$ in. (3) $\frac{5}{8}$ in.

(2) $\frac{7}{8}$ in. (4) $\frac{3}{4}$ in. c _____

d What is the length of the front view?

(1) $3\frac{1}{4}$ in. (3) $2\frac{7}{8}$ in.

(2) $2\frac{1}{8}$ in. (4) $3\frac{1}{8}$ in. d _____

e What is the size of dimension Z?

(1) $1\frac{7}{16}$ in. (3) $1\frac{3}{4}$ in.

(2) $1\frac{7}{8}$ in. (4) $2\frac{3}{16}$ in. e _____

185 Base your answers to parts a through e on the thread designation given below.

$$1\frac{3}{4} - 12 - NF - 2$$

On the line at the left of each part of the thread designation listed in parts a through e, write the number of the term, chosen from the list below, which best identifies that part. [5]

Terms

(1) First thread size
(2) Class of fit
(3) Thread series
(4) National Thread Form
(5) Root diameter
(6) Major diameter
(7) New form thread
(8) Threads per inch

_____ a $1\frac{3}{4}$

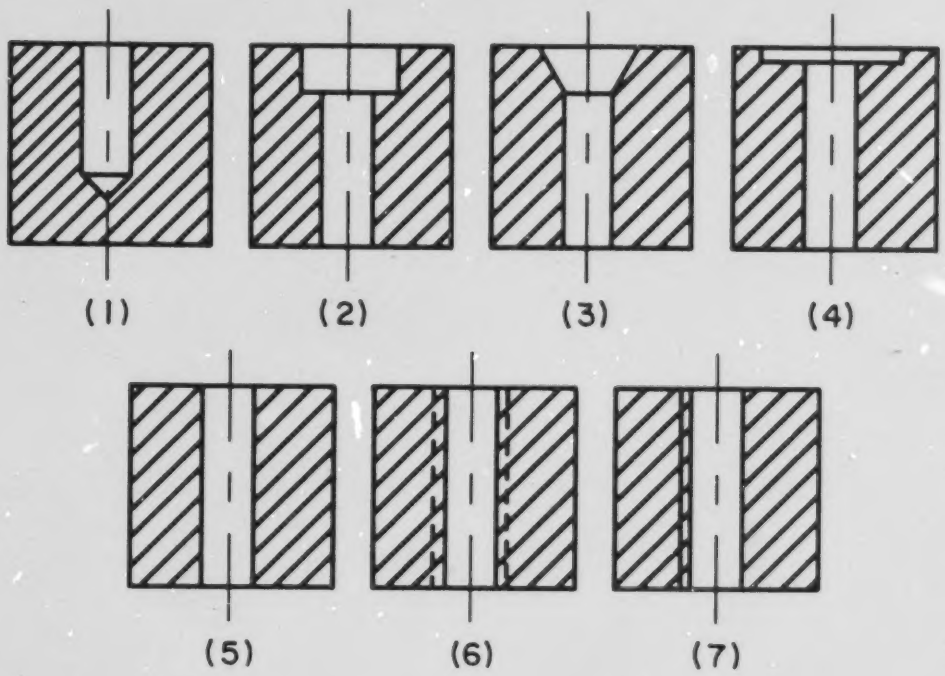
_____ b 12

_____ c N

_____ d F

_____ e 2

186 On the line at the left of each machine operation in parts a through e, write the number of the diagram, chosen from the list below, that illustrates that operation. [5]



_____ a counterboring

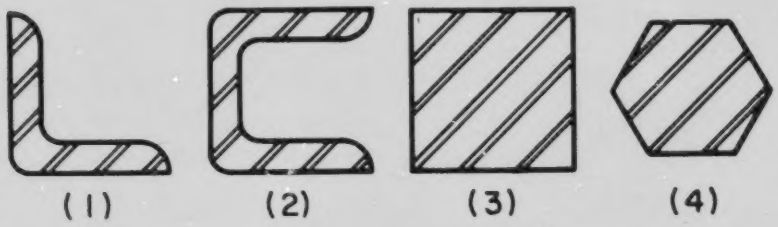
_____ b keyway

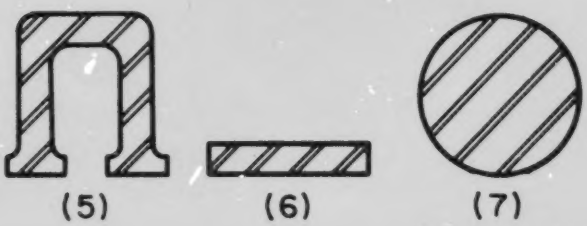
_____ c broaching

_____ d spot face

_____ e drilling

187 On the line at the left of each type of common stock in parts a through e below, write the number of the diagram, chosen from the list below, which best illustrates that stock. [5]





_____ a channel

_____ b extrusion

_____ c round

_____ d plate

_____ e hex bar

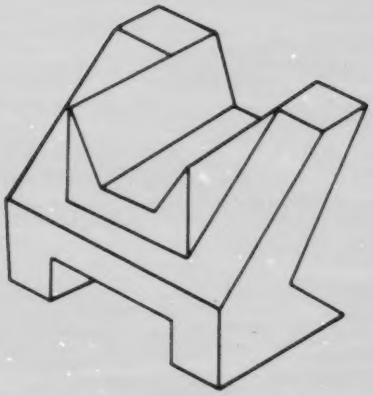
Industrial Arts - Drawing

Scoring Key

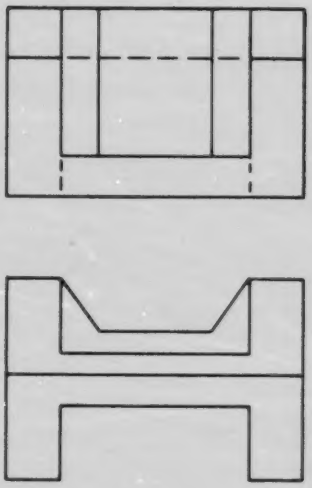
Multiple Choice Questions

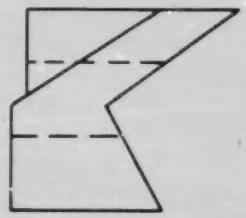
(1) 4	(44) 3	(87) 1	(130) 1
(2) 1	(45) 1	(88) 4	(131) 4
(3) 4	(46) 1	(89) 1	(132) 3
(4) 3	(47) 2	(90) 4	(133) 1
(5) 2	(48) 2	(91) 3	(134) 2
(6) 2	(49) 3	(92) 4	(135) 4
(7) 1	(50) 2	(93) 3	(136) 3
(8) 2	(51) 1	(94) 2	(137) 3
(9) 4	(52) 3	(95) 4	(138) 2
(10) 2	(53) 3	(96) 1	(139) 1
(11) 2	(54) 4	(97) 3	(140) 1
(12) 3	(55) 1	(98) 3	(141) 4
(13) 1	(56) 4	(99) 4	(142) 1
(14) 2	(57) 2	(100) 4	(143) 2
(15) 4	(58) 1	(101) 3	(144) 3
(16) 1	(59) 2	(102) 4	(145) 1
(17) 3	(60) 4	(103) 2	(146) 1
(18) 4	(61) 1	(104) 2	(147) 4
(19) 3	(62) 2	(105) 4	(148) 4
(20) 3	(63) 1	(106) 4	(149) 2
(21) 2	(64) 3	(107) 3	(150) 3
(22) 3	(65) 2	(108) 1	(151) 3
(23) 1	(66) 1	(109) 4	(152) 2
(24) 4	(67) 1	(110) 2	(153) 2
(25) 1	(68) 2	(111) 4	(154) 1
(26) 3	(69) 2	(112) 2	(155) 4
(27) 4	(70) 3	(113) 1	(156) 2
(28) 3	(71) 3	(114) 4	(157) 3
(29) 2	(72) 4	(115) 2	(158) 3
(30) 3	(73) 3	(116) 1	(159) 1
(31) 4	(74) 4	(117) 3	(160) 3
(32) 2	(75) 3	(118) 1	(161) 2
(33) 2	(76) 1	(119) 1	(162) 3
(34) 1	(77) 1	(120) 2	(163) 2
(35) 4	(78) 2	(121) 4	(164) 1
(36) 4	(79) 1	(122) 2	(165) 3
(37) 2	(80) 1	(123) 3	(166) 2
(38) 2	(81) 2	(124) 1	(167) 4
(39) 4	(82) 4	(125) 3	(168) 1
(40) 3	(83) 2	(126) 2	(169) 4
(41) 2	(84) 1	(127) 3	(170) 1
(42) 4	(85) 2	(128) 2	
(43) 3	(86) 3	(129) 4	

171



(a) ISOMETRIC

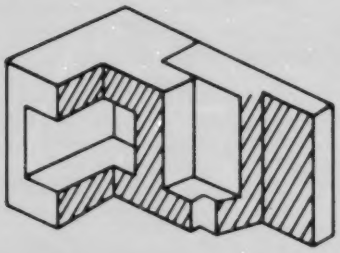




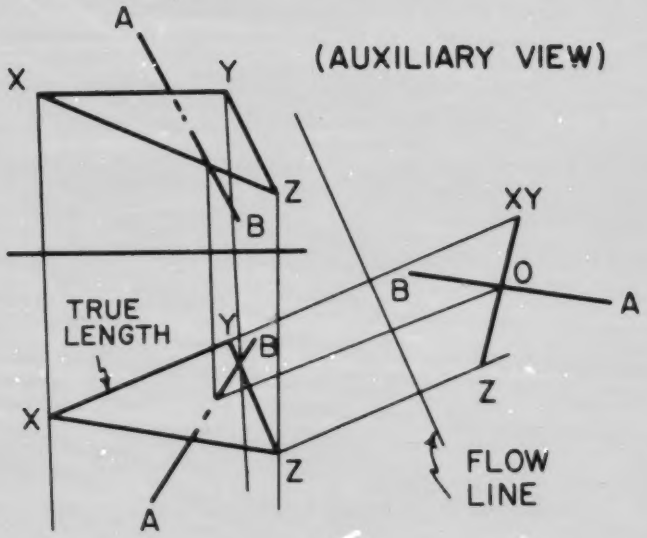
(b) SIDE VIEW

172

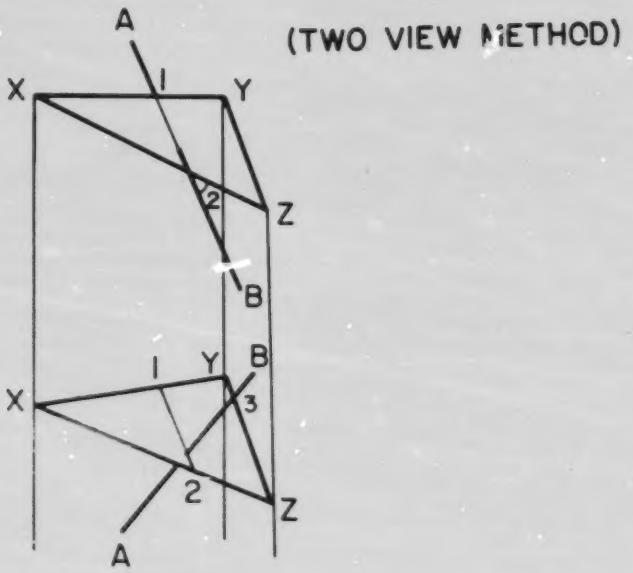
ISOMETRIC SECTION



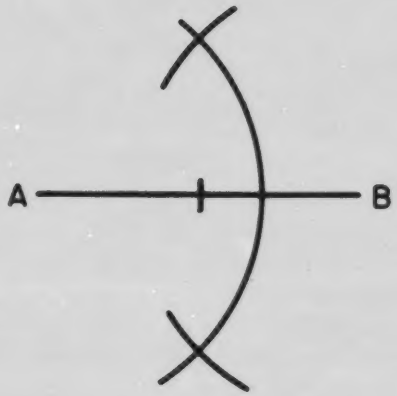
173 a



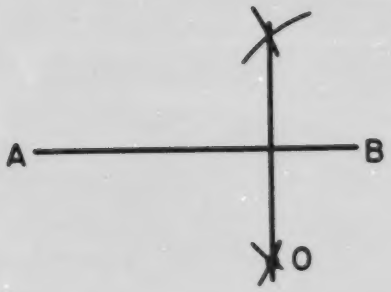
b



174

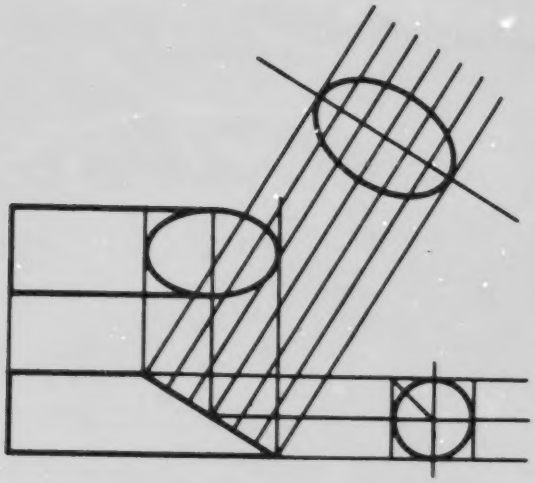


175



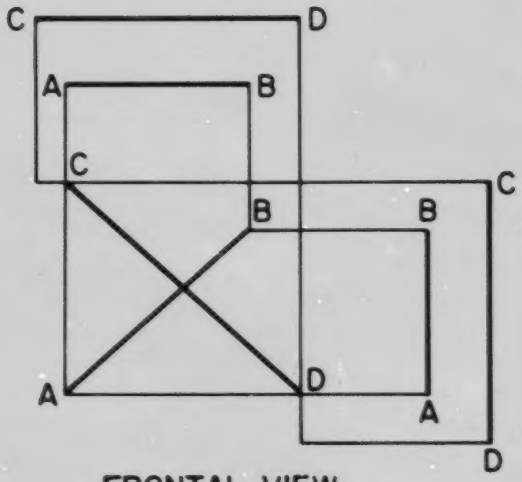
176

AUXILIARY VIEW



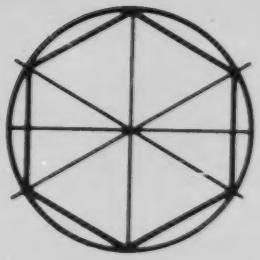
177

178

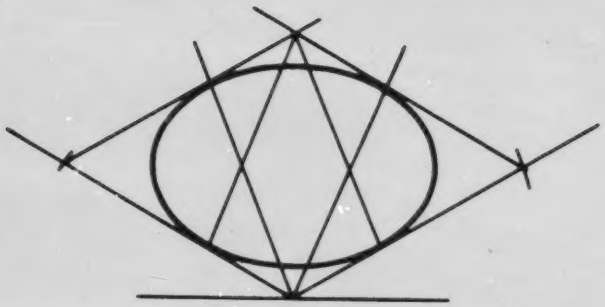


FRONTAL VIEW

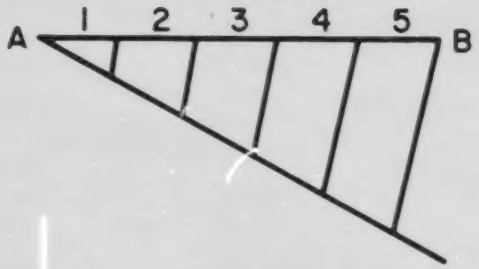
179



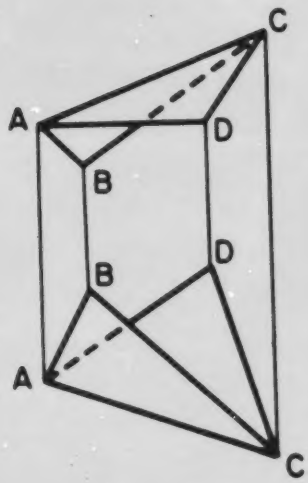
180



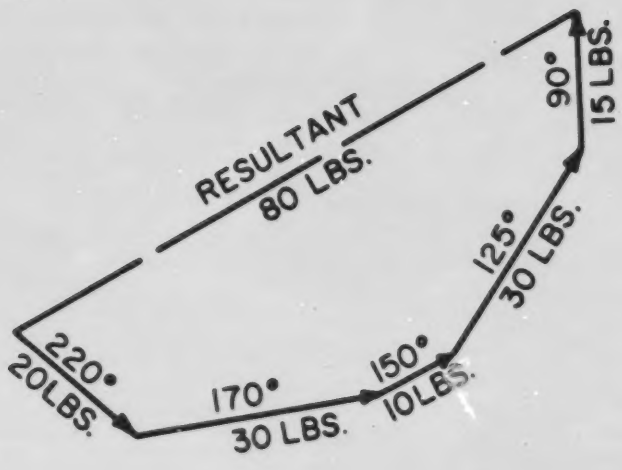
181



182


C
A
D
B
D
B
A
C

183


RESULTANT
80 LBS.
90°
15 LBS.
125°
30 LBS.
150°
10 LBS.
170°
30 LBS.
220°
20 LBS.

184 a 3
b 1
c 3
d 4
e 2

185 a 6
b 8
c 4
d 3
e 2

186 a 2
b 7
c 5
d 4
e 1

187 a 2
b 5
c 8
d 6
e 4

Industrial Arts Examination Materials

ELECTRICITY and ELECTRONICS

Multiple Choice

Directions (1-148): In the space provided write the number preceding the word or expression that, of those given, best completes the statement or answers the question.

Part I - Electricity

Unit A. Theory (1-17)

1 The resistance of a conductor can be decreased by

1 decreasing its length
2 heating it
3 decreasing its diameter
4 covering it with insulation 1_____

2 Which choice is a unit of resistance?

1 volt
2 ohm
3 ampere
4 watt 2_____

3 What would be the value of a resistor with red, green, and orange bands?

(1) 25.3 ohms
(2) 253 ohms
(3) 15,000 ohms
(4) 25,000 ohms 3_____

4 Which are the four factors that affect the resistance of a wire?

1 length, width, diameter, and amount of insulation
2 size, length, temperature, and type of material
3 length, diameter, temperature, and type of material
4 length, thickness, size, and type of material 4_____

5 Which equation states Ohm's law?

(1) $E = I \times R$
(2) $P = I \times E$
(3) $E = \frac{P}{I}$
(4) $I = \frac{R}{E}$

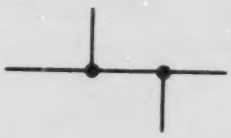
5_____

6 The prefix kilo means

(1) 10
(2) 100
(3) 1,000
(4) 10,000

6_____

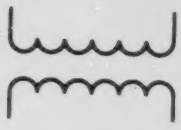
7 Which diagram shows the electrical symbol for a ground?



(1)

(3)

(2)



(4)

7_____

8 What is the law of magnetism?

1 Like poles attract and unlike poles repel.
2 Like poles repel and unlike poles attract.
3 Both like and unlike poles attract.
4 Both like and unlike poles repel. 8_____

9 The ability of magnetic materials to concentrate lines of force is called

1 reluctance
2 inductance
3 magnetomotive force
4 permeability 9_____

10 Which material would remain magnetized the longest?

1 silver
2 iron
3 copper
4 alnico 10_____

11 What kind of insulating material is used most often on magnet wire?

1 plastic
2 rubber
3 enamel
4 cotton 11_____

12 Which material is the better insulator?

1 copper
2 aluminum
3 glass
4 soft iron 12_____

13 The nucleus of an atom is made of

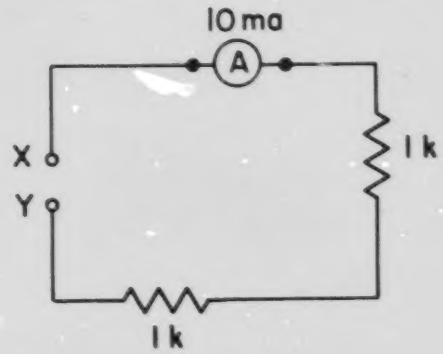
1 protons and neutrons, only
2 electrons and neutrons, only
3 protons and electrons, only
4 protons, electrons, and neutrons 13_____

14 Which material is the better conductor of electricity?

1 nichrome
2 iron
3 aluminum
4 copper

14_____

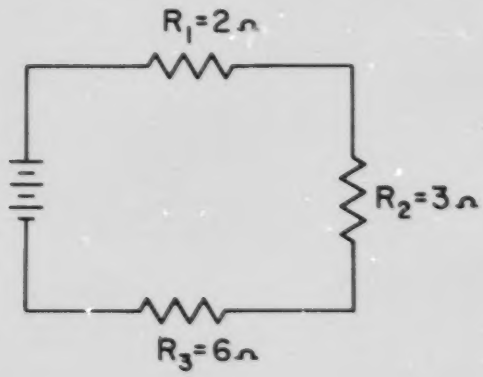
15 What is the voltage between points X and Y in the circuit shown below?



(1) 20 volts
(2) 40 volts
(3) 60 volts
(4) 80 volts

15_____

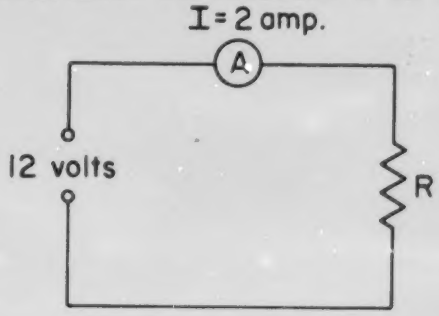
16 What is the total resistance of the circuit shown below?



(1) 1 ohm
(2) 2 ohms
(3) 6 ohms
(4) 11 ohms

16_____

17 What is the resistance of resistor R in the circuit shown below?

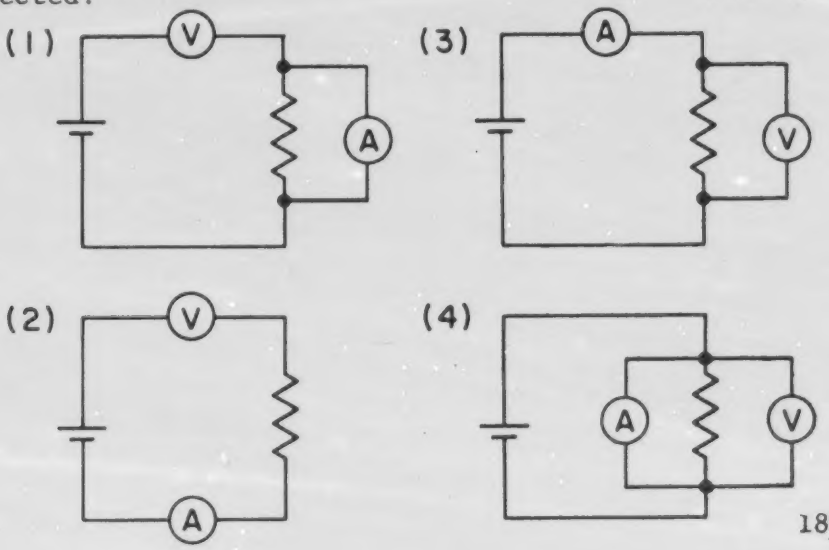


(1) 6 ohms
(2) 10 ohms
(3) 14 ohms
(4) 24 ohms

17_____

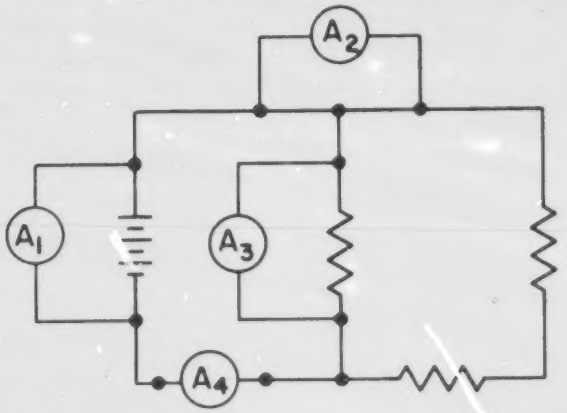
Unit B. Measurement (18-23)

18 In which circuit are the voltmeter (V) and ammeter (A) correctly connected?



18_____

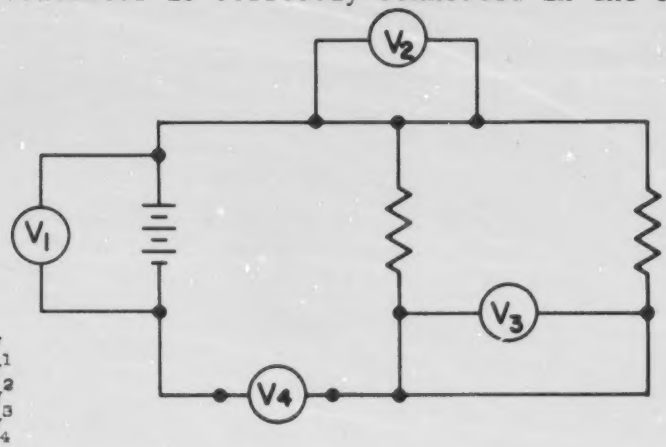
19 Which ammeter is connected correctly in the circuit below?



(1) A_1
(2) A_2
(3) A_3
(4) A_4

19_____

20 Which voltmeter is correctly connected in the circuit shown below?



(1) V_1
(2) V_2
(3) V_3
(4) V_4

20_____

21 How should an ohmmeter be adjusted before it is used?

1 Zero adjust the left end, only.
2 Zero adjust the right end, only.
3 Zero adjust to the middle.
4 Zero adjust both ends.

21_____

22 At what range should the scale of a voltmeter be set if the circuit reading is approximately 100 volts?

(1) 0-1,000 volts
(2) 0-500 volts
(3) 0-150 volts
(4) 0-100 volts

22_____

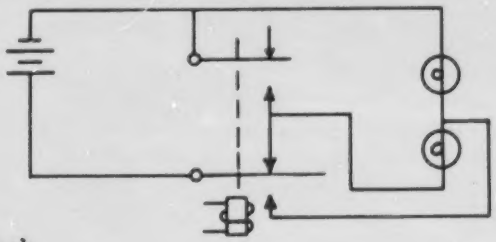
23 Reactance is measured in

1 henries
2 ohms
3 farads
4 volts

23_____

Unit C: Circuitry (24-33)

24 Which type of switch is used in the relay circuit shown below?

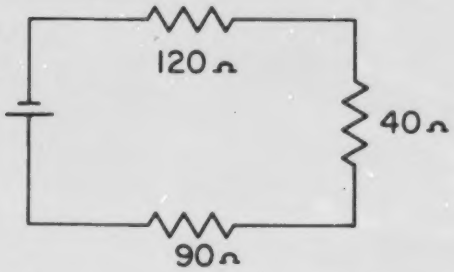


(1) SPST switch
(2) DPST switch
(3) DPDT switch
(4) SPDT switch

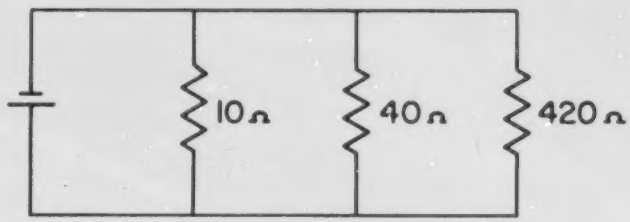
24_____

25 Which circuit below has a total resistance of 470Ω?

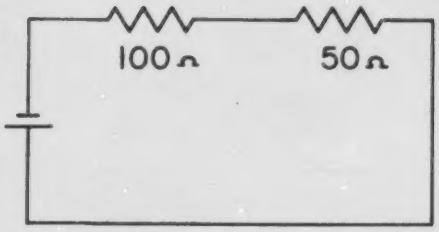
(1)



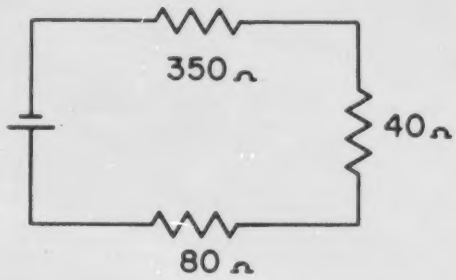
(3)



(2)

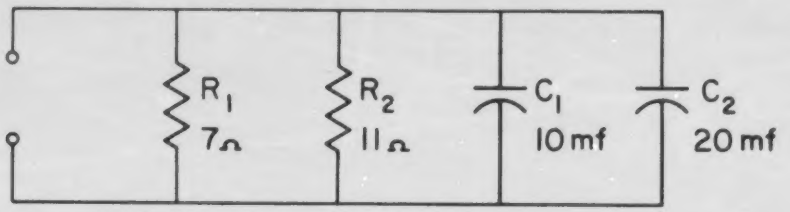


(4)



25_____

26 Which component in the circuit shown below will dissipate the greatest amount of heat?



(1) R_1
(2) R_2
(3) C_1
(4) C_2

26_____

27 Which choice is a unit of capacitance?

1 a henry
2 a farad
3 an ohm
4 a volt

27_____

28 What is the total capacitance of two .02-mfd. capacitors connected in series?

(1) .01 ufd.
(2) .02 ufd.
(3) .08 ufd.
(4) .04 ufd.

28_____

29 What is the total capacitance of two 50-microfarad capacitors connected in series?

(1) 12.5 ufd.
(2) 25 ufd.
(3) 50 ufd.
(4) 100 ufd.

29_____

30 A capacitor is a device which opposes any change in the circuit's

1 current
2 voltage
3 inductance
4 resistance

30_____

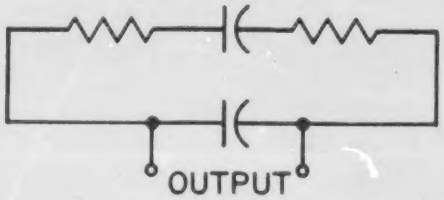
31 What is the total inductance of two 4-henry chokes connected in series?

(1) 12 henries
(2) 2 henries
(3) 8 henries
(4) 4 henries

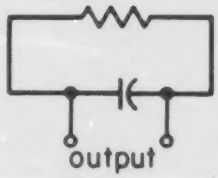
31_____

32 Which choice is the equivalent of the circuit shown in figure A below?

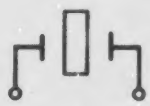
FIGURE A



(1)



(3)



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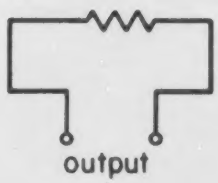

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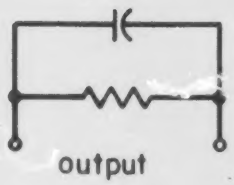


32_____

33 Circuit continuity can be measured with

1 a VOM
2 a voltmeter
3 an ammeter
4 a hydrometer

33_____

Unit D: Motors (34-38)

34 What type of motor is used to operate cranes, hoists, and locomotives?

1 shunt
2 compound
3 universal
4 series

34_____

35 What motor can be run on either a.c. or d.c. current?

1 compound
2 universal
3 shunt
4 repulsion

35_____

36 What is <u>not</u> reversed by the reversing switch on a d.c. motor?

1 the polarity of poles
2 armature current
3 the line frequency
4 the direction of rotation of motor

36_____

37 Which motor operates on d.c. current?

1 shunt motor
2 selsyn motor
3 synchronous motor
4 induction motor

37_____

38 Which equation would be used to find the speed (r.p.m.) of a synchronous motor?

(1) $\text{r.p.m.} = \dfrac{60 \times \text{voltage} \times \text{frequency}}{\text{No. of pairs of poles}}$

(2) $\text{r.p.m.} = \dfrac{60 \times \text{frequency}}{\text{No. of pairs of poles}}$

(3) $\text{r.p.m.} = \dfrac{180 \times \text{voltage} \times \text{frequency}}{\text{No. of poles}}$

(4) $\text{r.p.m.} = \dfrac{180 \times \text{frequency}}{\text{No. of poles}}$

38_____

Unit E: Light-Heat (39-47)

39 What is the ignition voltage of a NE2 neon lamp?

(1) 1.5 volts
(2) 10 volts
(3) 50 volts
(4) 90 volts

39_____

40 The function of the grounding wire inside a Romex cable is to

1 strengthen the wire
2 carry the current to the load
3 provide a low-resistance path to the ground
4 carry heat away from the load

40_____

41 What size wire is used for the lighting circuits in a home?

(1) #8
(2) #12
(3) #16
(4) #20

41_____

42 What part of the fluorescent light fixture limits the current to the lamp?

1 ballast
2 filament
3 starter
4 mercury

42_____

43 Who invented the incandescent light?

1 Franklin
2 Edison
3 De Forest
4 Marconi

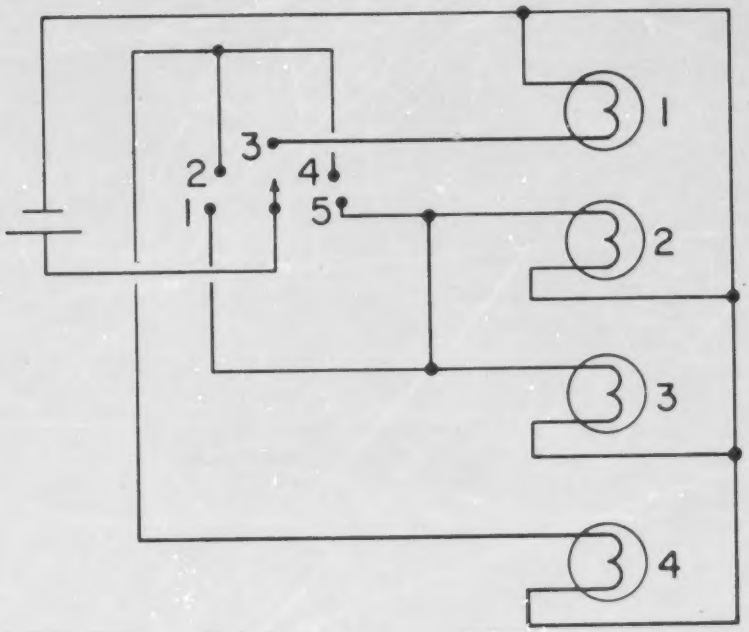
43_____

44 Which is a safety device used to prevent an electrical circuit from becoming overloaded?

1 resistor
2 switch
3 fuse
4 capacitor

44_____

45 When the switch is in position #1, which lights will go on?



(1) 1 and 2
(2) 2 and 3
(3) 3 and 4
(4) 1 and 3

45_____

46 Three ways that heat is transferred from its source to the object being heated are

1 induction, convection, and radiation
2 conduction, resistance, and radiation
3 conduction, convection, and radiation
4 resistance, induction, and radiation

46_____

47 If line frequency to a light bulb dropped to 20 c.p.s., what would happen?

1 The light would dim but remain lit.
2 The light would brighten.
3 The light would burn out.
4 The light would flicker.

47_____

Unit F: Batteries and Generators (48-55)

48 Theoretically, for how many hours can a 100-ampere-hour battery deliver 2 amperes before it is completely discharged?

(1) 50
(2) 2
(3) 100
(4) 200 48_____

49 What is the output voltage and amperage of three 1½-volt, 20-ampere cells connected in series?

(1) 1½ v. - 20 amp.
(2) 4½ v. - 20 amp.
(3) 1½ v. - 60 amp.
(4) 4½ v. - 60 amp. 49_____

50 Which type of cell can be recharged?

1 mercury
2 carbon-zinc
3 alkaline
4 nickel-cadmium 50_____

51 What is the electrolyte in a lead-acid storage cell?

1 lead triphosphate
2 lead and ascorbic acid
3 sulphuric acid and distilled water
4 nitric acid and distilled water 51_____

52 Battery storage capacity is rated in

1 ampere-hours
2 volts
3 coulombs
4 power factors 52_____

53 What will stop the sulphation of a secondary cell?

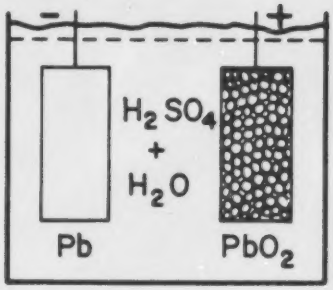
1 an occasional overcharge
2 an occasional undercharge
3 adding a desulphurate solution
4 quickly discharging the cell 53_____

54 Which type of cell is a dry cell battery?

1 voltaic cell
2 secondary cell
3 primary cell
4 wet cell

54_____

55 The battery shown below is



1 completely charged
2 being charged
3 being discharged
4 completely discharged

55_____

Unit G: Power Generation and Transmission (56-61)

56 Which device is used to run a generator in a power station?

1 transformer
2 turbine
3 alternator
4 fuel cell

56_____

57 Which device is used at the generating plant to increase the voltage before it is transmitted across the country?

1 transformer
2 converter
3 generator
4 turbine

57_____

58 How many watts are equal to one horsepower?

(1) 360
(2) 400
(3) 600
(4) 746

58_____

59 The purpose of impedance matching is to provide maximum

1 power transfer
2 phase difference
3 antenna current
4 resistance

59_____

60 The frequency of most power generated in the United States is

(1) 30 c.p.s.
(2) 40 c.p.s.
(3) 60 c.p.s.
(4) 117 c.p.s.

60_____

61 Hydroelectric power is produced by

1 water
2 wind
3 sunlight
4 atomic energy

61_____

Unit H: Industrial Organization (62)

62 What organization will test any electrical component or appliance and give it a stamp of approval if it meets certain safety standards?

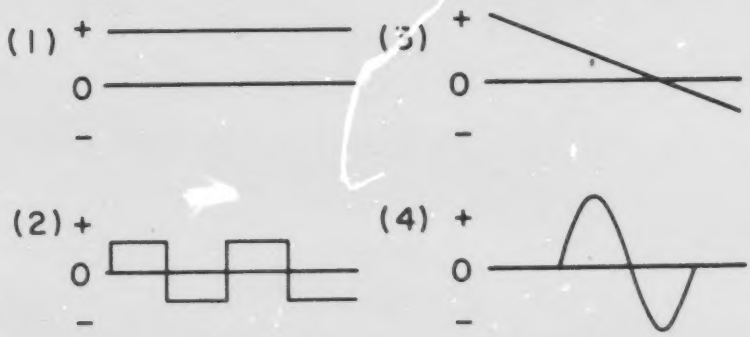
1 National Association of Home Builders
2 International Brotherhood of Electrical Workers
3 Underwriters Laboratories, Inc.
4 Electronic Industries Assoc.

62_____

Part II: Electronics

Unit A: Science Review (63-71)

63 Which diagram below shows a sine wave?



63_____

64 What particle of the atoms in a copper wire becomes the current through the conductor?

1 nucleus
2 proton
3 electron
4 neutron

64_____

65 What is the wavelength of a transmitted frequency of 4.0 mc.?

(1) 50 meters
(2) 75 meters
(3) 100 meters
(4) 125 meters

65_____

66 In order to obtain maximum amplification, the load resistor of an amplifier should always be

1 less then the a.c. plate resistance.
2 equal to the plate resistance.
3 several times higher then the plate resistance.
4 thousands of times higher then the plate resistance. 66_____

67 How much must the power level of an amplifier be increased from two watts before any change in loudness could be heard by most people? (The sound ratio of 1.26 equals one decibel.)

(1) 2.5 watts
(2) 3 watts
(3) 3.5 watts
(4) 4 watts 67_____

68 What is the decibel gain of an amplifier if the input power is 1 watt and the output power is 10 watts?

(1) 5 db
(2) 10 db
(3) 15 db
(4) 20 db 68_____

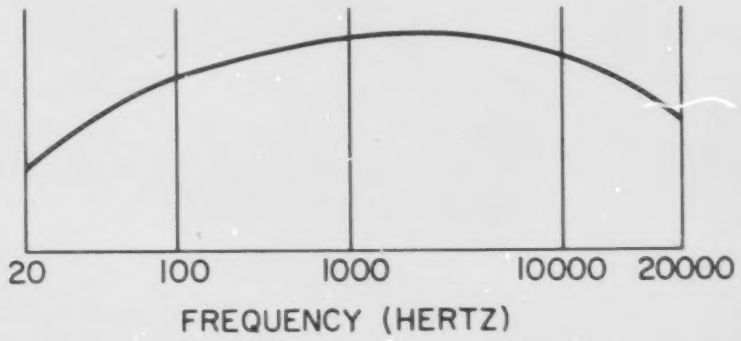
69 Which field transmitted by an antenna system determines its own polarization?

1 magnetic field
2 electrostatic field
3 gravitational field
4 standing wave ratio field 69_____

70 What is the a.c. output voltage of a triode amplifier stage which has the following values: R_L = 50,000 ohms, r_p = 5,000 ohms, mu = to 30, and e_g = .3 volt?

(1) 6.1 volts
(2) 7.1 volts
(3) 8.1 volts
(4) 9.1 volts 70_____

71 The frequency response curve for a resistance coupled audio amplifier is shown below. What should be done to improve the low frequency response section of the curve?



1 Increase the plate voltage of the tube.
2 Increase the size of the coupling capacitor.
3 Increase the size of the load resistor.
4 Reduce the size of the load resistor.

71_____

Unit B: Meters and Instruments (72-81)

72 What is one advantage of the multimeter over single purpose meters?

1 It is less expensive.
2 It is easier to read.
3 It is more versatile.
4 It is better built.

72_____

73 The internal resistance of an ammeter is 10 ohms. What size shunt is needed in the ammeter to extend the range from 1 ma. to 5 ma.?

(1) 1.5 ohms
(2) 2.5 ohms
(3) 3.5 ohms
(4) 4.5 ohms

73_____

74 A d.c. voltmeter has an internal resistance of 1000 ohms for a 0 - 1 ma. range. What size multiplier resistor should be put in series with the meter resistance to convert the meter range to 0 - 100 volts?

(1) 900 ohms
(2) 9900 ohms
(3) 90,000 ohms
(4) 99,000 ohms

74_____

75 At what range should a multimeter be set for a voltage reading of 50 volts?

(1) 10
(2) 100
(3) 500
(4) 1000

75_____

76 What type of a[illegible]er should be used to measure currents when the frequency does not exceed 20,000 hertz?

1 copper oxide rectifier
2 thermocouple
3 hot wire
4 selenium rectifier

76_____

77 What voltage reading is shown on the scale below?

(1) 4.3 volts
(2) 4.2 volts
(3) 4.1 volts
(4) 4 volts

77_____

78 The most sensitive meter would be one with a current range of

(1) 0-1 mA
(2) 0-10 mA
(3) 0-50 μA
(4) 0-500 μA

78_____

79 Which instrument will give the most accurate resistance measurements?

1 Wheatstone bridge
2 ohmmeter
3 VOM
4 multimeter

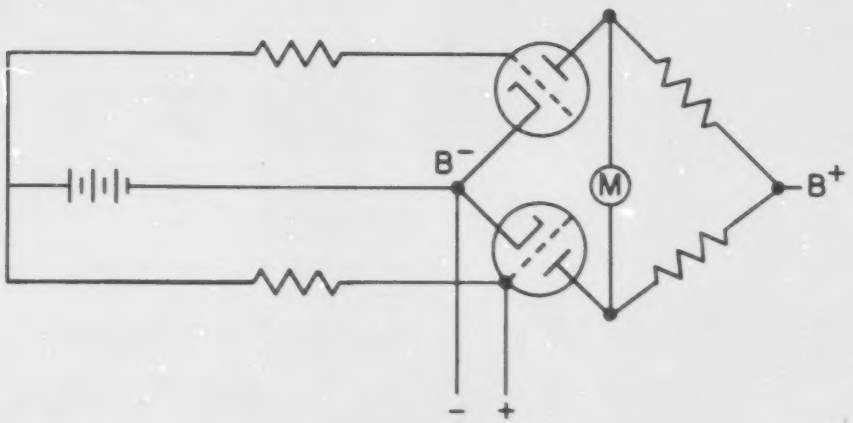
79_____

80 What control on the oscilloscope is used to set the frequency of the sawtooth generator inside the scope?

1 horizontal positioning
2 vertical gain
3 focusing
4 sweep

80_____

81 The diagram below shows the electrical circuit of a



(1) VOM
(2) VTVM
(3) phase difference meter
(4) differential resistance decoder

81_____

Unit C: Inductance and Capacitance (82-90)

82 In order to prevent magnetic coupling between interstage leads the leads should be

1 shielded
2 immersed in water
3 made as short as possible
4 made from parallel zip cord 82_____

83 The coupling coefficient between two coils can be increased by

1 adding more windings
2 increasing the current
3 using smaller diameter wire
4 moving the windings closer together 83_____

84 A loudspeaker with an impedance of 4.7 is used in a plate circuit that has an impedance of 3,200 ohms. What is the turns ratio used in the transformer?

(1) 4.7 to 1
(2) 31.6 to 1
(3) 68.1 to 1
(4) 3,200 to 1 84_____

85 The strength of an electromagnet can be increased by

1 increasing the amount of insulation
2 decreasing the volts and turns
3 increasing the amperes and turns
4 decreasing the amperes and turns 85_____

86 How much does voltage lag the current in a purely capacitive circuit?

(1) 45°
(2) 90°
(3) 180°
(4) 360° 86_____

87 What is the phase relationship of the voltage to the current in a capacitive reactive circuit?

1 The voltage and current are in phase.
2 The current leads the voltage by 90°.
3 The voltage leads the current by 90°.
4 The voltage and current are 180° out of phase. 87_____

88 What is the inductive reactance of a 2-henry coil in a circuit where the frequency is 60 hertz?

(1) 120 ohms
(2) 377 ohms
(3) 754 ohms
(4) 1,000 ohms 88_____

89 A transformer has 120 volts across the primary and 12 volts across the secondary. If the primary has 1,000 turns, then the secondary must have

(1) 50 turns
(2) 100 turns
(3) 150 turns
(4) 200 turns 89_____

90 A capacitor and a resistor are connected in series and a d.c. voltage has been applied to the circuit. The amount of time it takes to charge the capacitor depends on the

1 size of the capacitor, only
2 amount of voltage applied, only
3 size of the resistor and the amount of voltage applied
4 size of both the resistor and the capacitor 90_____

Unit D: Tubes and Semiconductors (91-99)

91 Which tube below operates only as a rectifier tube?

(1) 12BE6
(2) 12AU6
(3) 35W4
(4) 50C5

91_____

92 In the tube number 35W4, the first two numbers designate the

1 filament voltage
2 plate voltage
3 grid voltage
4 number of active elements

92_____

93 In a pentode tube, the suppressor is located between the

1 envelope and the plate
2 screen grid and the control grid
3 screen grid and the plate
4 cathode and the screen grid

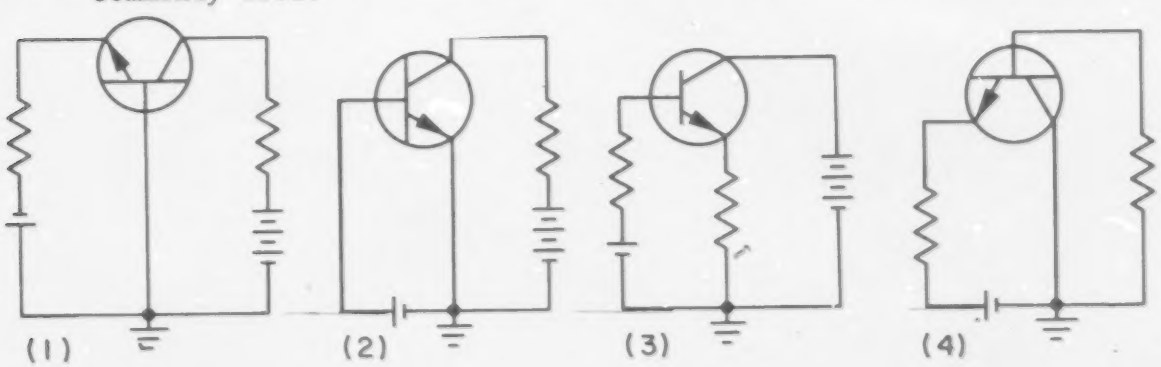
93_____

94 The dot in a schematic symbol of a tube means that the tube is a

1 high radiation tube
2 high voltage tube
3 high amperage tube
4 gas filled tube

94_____

95 What amplifier circuit configuration shown below is most commonly used?



95_____

96 If the V_F is 6 volts and the limiting resistance is 1000 ohms, what would be the I_F of a diode circuit?

(1) 6 ma.
(2) 2 ma.
(3) 8 ma.
(4) 4 ma.

96_____

97 In an N-type semiconductor, how many valence electrons will be in the doping atom?

(1) 1
(2) 5
(3) 3
(4) 7

97_____

98 Which two elements are used to make semiconductors?

1 cobalt and germanium
2 carbon and silicon
3 germanium and silicon
4 sulfur and iron

98_____

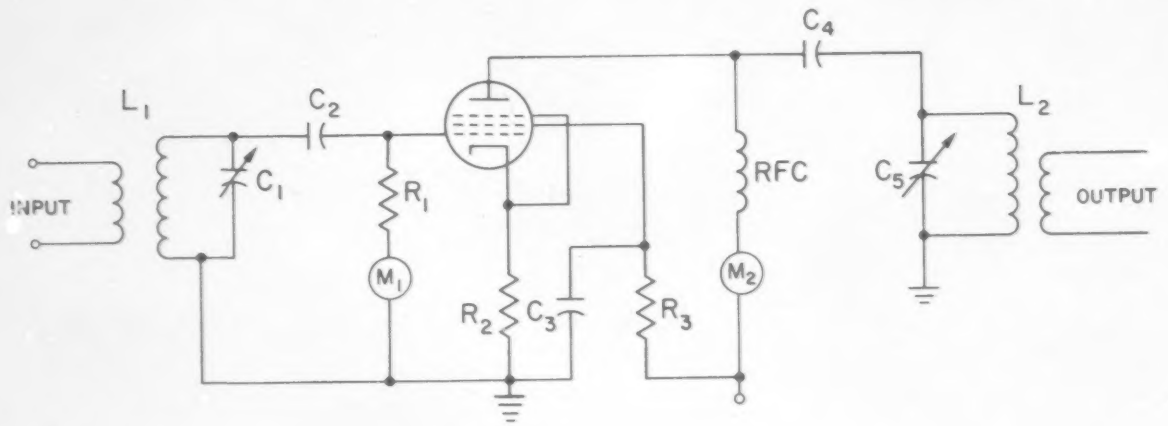
99 The process of changing a.c. to d.c. is called

1 amplification
2 modulation
3 rectification
4 oscillation

99_____

Unit E: Amplifiers - Oscillators (100-119)

Base your answers to questions 100 and 101 on the diagram below.



100 How would the reading of M_1 be affected if resistor R_1 were to open?

1 It would increase.
2 It would remain the same.
3 It would decrease, but not to zero.
4 It would decrease to zero.

100_____

101 How would the reading of M_2 be affected if capacitor C_4 were to be shorted?

1 It would increase.
2 It would remain the same.
3 It would decrease, but not to zero.
4 It would decrease to zero.

101_____

102 What class of amplifier has its output current operating for 360° of the signal?

(1) A
(2) B
(3) C
(4) AB

102_____

103 How much out of phase should the output signals from the two tubes in a push-pull amplifier be?

(1) 0°
(2) 90°
(3) 180°
(4) 270°

103_____

104 What is the approximate plate efficiency of a Class B push-pull amplifier?

(1) 20%
(2) 50%
(3) 70%
(4) 90%

104_____

105 Which class amplifier gives undistorted true reproduction of the original wave?

(1) A
(2) B
(3) C
(4) AB

105_____

106 Which class amplifier is most efficient?

(1) A
(2) B
(3) C
(4) AB

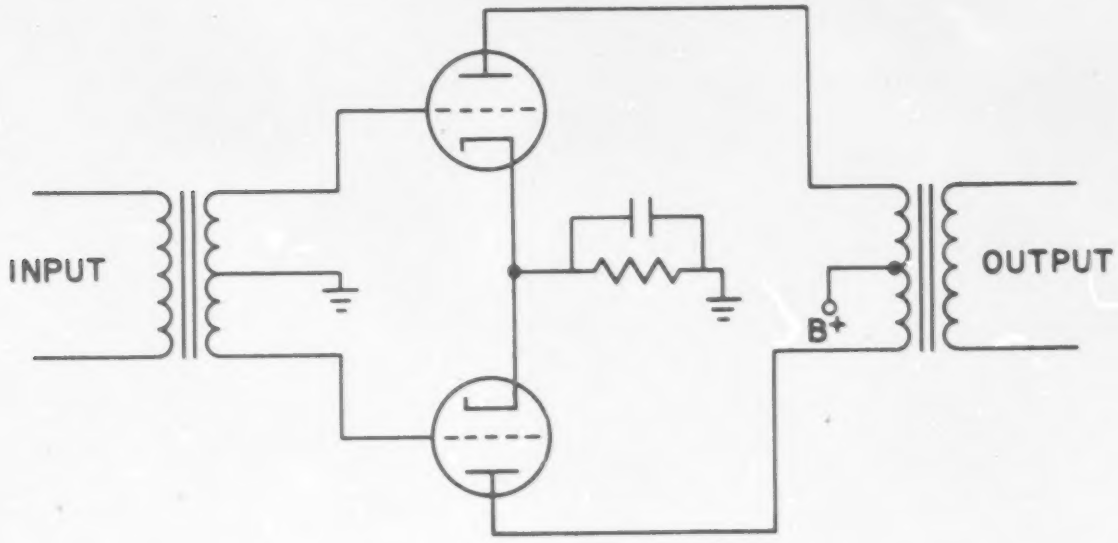
106_____

107 An audio amplifier has a sudden decrease in output, but an increase in quality. This is most likely caused by

1 a shorted cathode bypass capacitor
2 an open anode bypass capacitor
3 a discharging coil
4 a leaking grid bias

107_____

108 What kind of electrical circuit is shown in the diagram below?



1 Colpitts oscillator
2 dual triode rectifier circuit
3 harmonic amplifier
4 push-pull amplifier

108_____

109 What is the approximate efficiency of a class A amplifier?

(1) 5%
(2) 20%
(3) 50%
(4) 100%

109_____

110 Which is an advantage of a magnetic amplifier circuit over a vacuum tube circuit?

1 It produces less distortion.
2 It has a better frequency response.
3 It is more resistant to shock.
4 It requires less current.

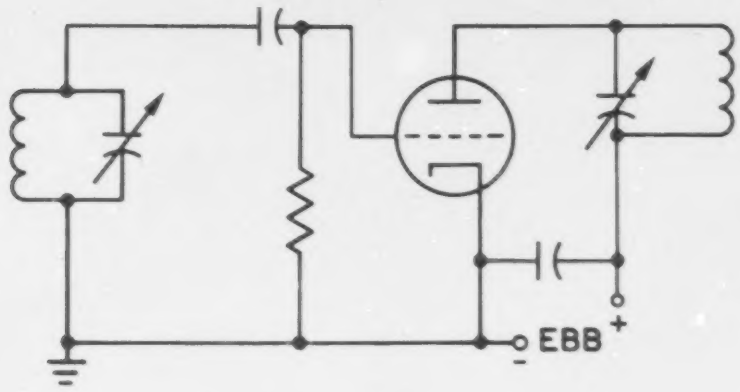
110_____

111 Which two components are used to make an oscillator?

1 a capacitor and a resistor
2 a transistor and a choke
3 a transformer and a coil
4 a capacitor and a coil

111_____

112 The diagram shown below is a schematic drawing of which choice?



1 an Armstrong preamplifier
2 a tuned grid-tuned plate oscillator
3 a Hartley series fed oscillator
4 a vacuum tube power supply

112_____

113 The RF input is 1,000 kc. and the local oscillator input is 1,455 kc. at the converter stage of a superheterodyne radio. What should be the intermediate frequency in this radio?

(1) 455 kc.
(2) 1,000 kc.
(3) 1,455 kc.
(4) 2,455 kc.

113_____

114 What part of an oscillator circuit determines the frequency of the current?

(1) amplifying tube
(2) LC network
(3) feedback network
(4) grid-leak section

114_____

115 If the plate current of a triode is increased, the plate resistance will

1 increase
2 decrease
3 remain the same
4 increase and then decrease

115_____

116 What is the Q of a tuned circuit if X_L is 500 ohms and R is 10 ohms?

(1) 50
(2) 500
(3) 5,000
(4) 50,000

116_____

117 What is the bandwidth of a tuned circuit with a Q of 100 and a resonant frequency of 100,000 Hz.?

(1) 100 Hz.
(2) 1,000 Hz.
(3) 10,000 Hz.
(4) 100,000 Hz.

117_____

118 What is the frequency of a series tuned circuit that has an inductance of 2 microhenries and a capacitance of .02 microfarad?

(1) 39.5 cycles
(2) 79.5 cycles
(3) 39,500 cycles
(4) 79,500 cycles

118_____

119 Which type of tube is used as a converter?

1 duodiode
2 duodiode-triode
3 twin-triode
4 pentagrid

119_____

Unit F: Radio and Television (120-135)

120 When the frequency of a signal is increased, its wavelength will

1 decrease, only
2 increase, only
3 remain the same
4 decrease and then increase 120_____

121 What bandwidth is needed for a complete television signal?

(1) 6 mc.
(2) 2 mc.
(3) 8 mc.
(4) 4 mc. 121_____

122 The bandwidth of the useful portion of a televisinn signal is

(1) 8.75 mc.
(2) 2.75 mc.
(3) 6.75 mc.
(4) 4.75 mc. 122_____

123 What type of audio signal is received by TV sets?

(1) AM
(2) FM
(3) SSB
(4) phase modulation 123_____

124 The voltage required by a black and white television tube is approximately:

(1) 350 - 400 volts
(2) 500 - 1000 volts
(3) 1000 - 6000 volts
(4) 8000 - 16,000 volts 124_____

125 What two types of fields are transmitted from the antenna of a radio station?

1 voltage and current
2 radio frequency and audio frequency
3 electromagnetic and electrostatic
4 gravitational and magnetic 125_____

126 Which device collects radio waves from a transmitting station?

1 capacitor
2 transistor
3 inductor
4 antenna

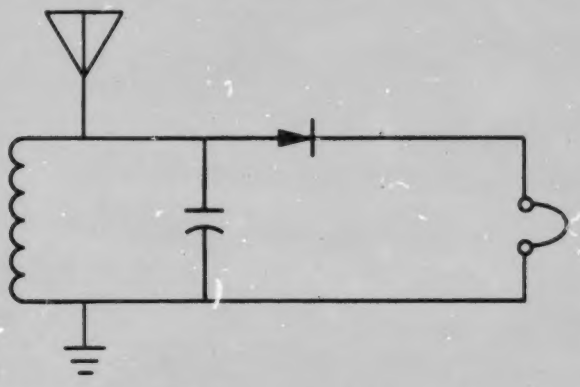
126_____

127 What part of a radio separates one radio station from all other stations?

1 antenna
2 oscillator
3 amplifier
4 tuner

127_____

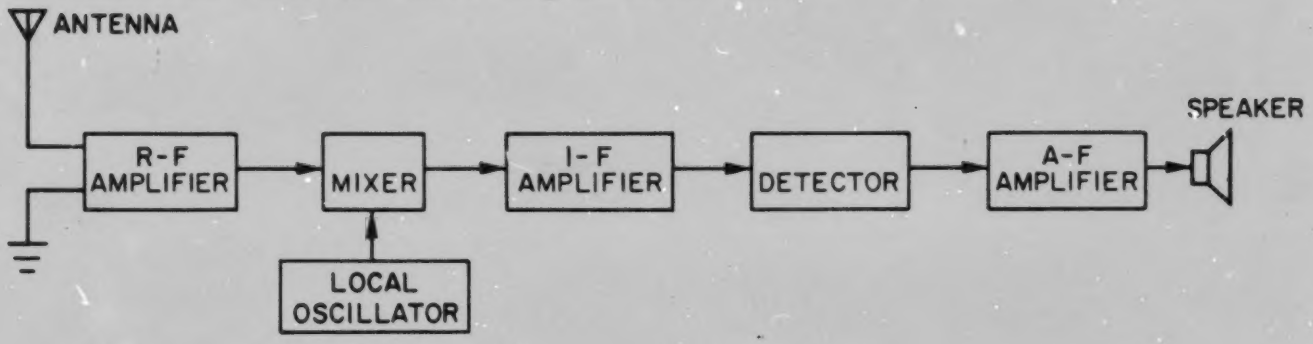
128 The diagram represents a



1 transmitter
2 transceiver
3 crystal radio
4 TRF

128_____

129 What does the block diagram below show?



1 a superheterodyne AM receiver
2 a monoheterodyne AM/FM receiver
3 a single-sided and suppressed carrier transmitter
4 a superheterodyne FM stereo receiver 129_____

130 What intermediate frequency signal is used in a superheterodyne radio whose radio frequencies are 1,455 kilocycles and 1,000 kilocycles?

(1) 455 kc.
(2) 1,000 kc.
(3) 1,455 kc.
(4) 2,455 kc. 130_____

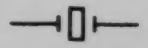
131 What is the frequency of the second harmonic of a 1,000 c.p.s. signal?

(1) 500 c.p.s.
(2) 998 c.p.s.
(3) 1,002 c.p.s.
(4) 2,000 c.p.s. 131_____

132 The speed of radio waves in free space is approximately

(1) 1,100 ft./min.
(2) 1,100 meters/sec.
(3) 186,000 mi./min.
(4) 300,000,000 meters/sec. 132_____

133 This symbol shown below represents



1 klystron tube
2 pressure tube
3 crystal
4 terminal board 133_____

134 Which microphone would be best to use to reproduce music?

1 carbon microphone
2 ribbon microphone
3 crystal microphone
4 dynamic microphone 134_____

135 What organization extablishes the rules and regulations for all interstate and foreign electrical communication systems originating in the U.S.?

1 Federal Communications Commission
2 Electronic Industries Association
3 Radio Electronic Television Manufacturer Association
4 Joint Electronic Device Engineering Council 135_____

Unit G: Controls and Computers (136-141)

136 A photoresistor is connected between the grid and B- of a vacuum tube. If the amount of light striking the photoresistor is decreased, the plate current will

1 increase, only
2 decrease, only
3 remain the same
4 decrease and then increase

136_____

137 In a logic circuit, which gate will always have an output if any of the inputs are active?

(1) AND
(2) OR
(3) NOT
(4) NAND

137_____

138 Which type of gate has an output only when all the input signals are active?

1 a NOR
2 a NAND
3 an AND
4 an OR

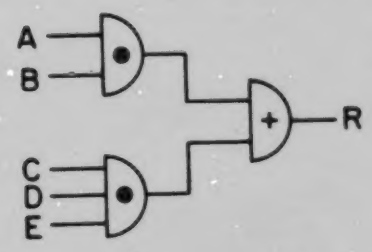
138_____

139 What is the sum of the binary numbers 101 and 11?

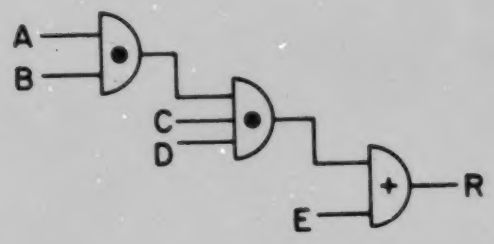
(1) 110
(2) 111
(3) 1100
(4) 1000

139_____

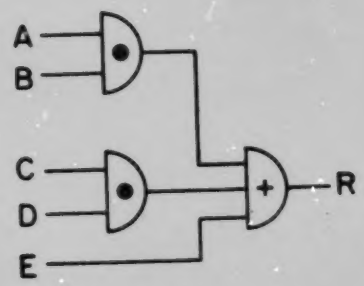
140 Which block diagram shown below represents the equation AB + CD + E = R?



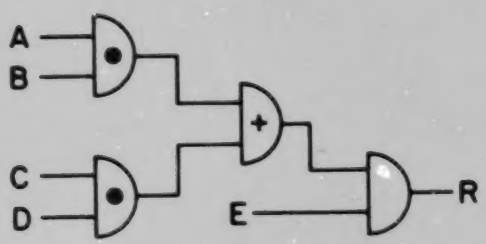
(1)



(3)



(2)



(4)

140_____

141 If a relay coil's resistance is 400 ohms and it pulls in at 200 ma., what is the pull-in voltage?

(1) 80 volts
(2) 40 volts
(3) 8 volts
(4) 4 volts

141_____

Unit P: Careers and Industry (142-148)

142 How many years must a person be an apprentice before he can become a licienced electrician?

(1) 2-3 years
(2) 4-5 years
(3) 6-7 years
(4) 8-9 years 142_____

143 What type of work does a maintenance electrician do?

1 He services telephones.
2 He repairs TV's and radios.
3 He repairs and maintains industrial equipment.
4 He designs and builds components and appliances. 143_____

144 Which group of workers in the telephone industry has the highest pay rate?

1 telephone craftsmen
2 telephone operators
3 clerical workers
4 maintenance and building service workers 144_____

145 In most broadcasting stations, approximately 50% of the full time staff are employed in

1 programming
2 engineering
3 sales
4 bookkeeping 145_____

146 Which type of worker in the light and power distribution occupations has the responsibility for constructing and maintaining the network of powerlines which carry the electricity from the generating plant to the consumer?

1 cable splicers
2 groundmen
3 load dispatchers
4 linemen 146_____

147 Which type of worker is most likely to be employed in research, development, and design activities in the electronic manufacturing industry?

1 construction electrician
2 maintenance electrician
3 electrical engineer
4 service technician

147_____

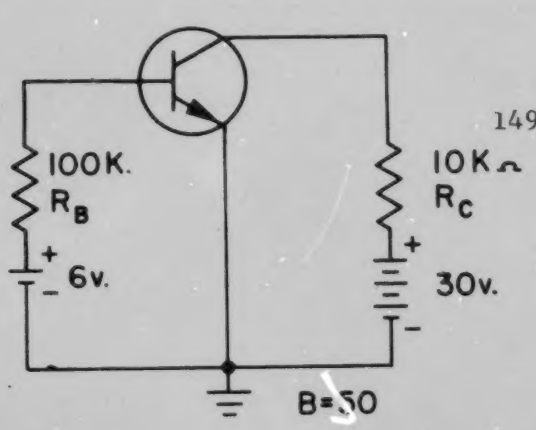
148 What type of FCC license must a broadcast technician have in order to operate and adjust transmitters and related equipment?

1 Amateur Radio License
2 Citizen Band License
3 Third Class Operators License
4 Radio Telephone First Class License

148_____

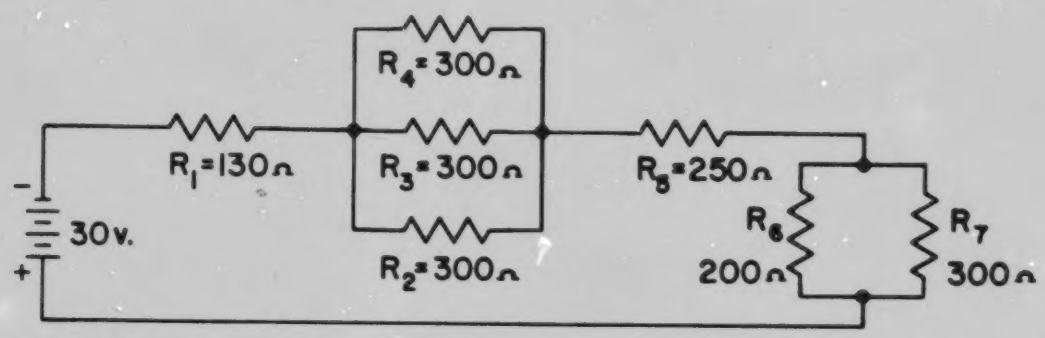
Group Questions (149-158)

149 Calculate the I_C of the common emitter circuit shown below. A silicon transistor is used in the circuit. [5]



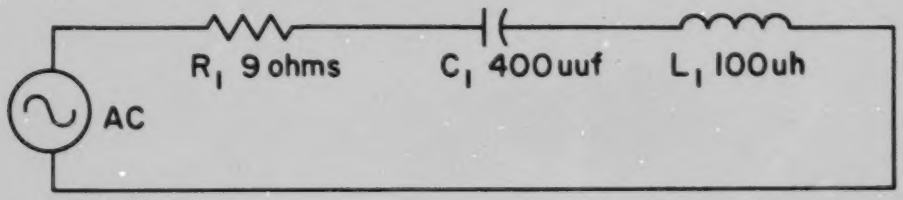
149 _____

150 Base your answers to parts a through e on the diagram of the series-parallel circuit below. [5]



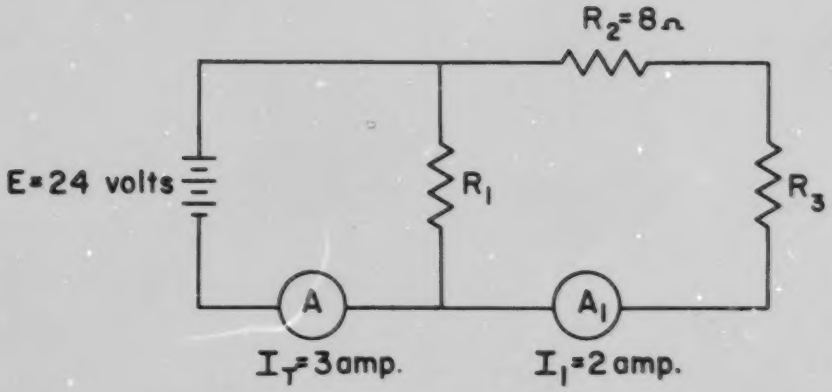
a Determine the value of R_T. _____
b Determine the value of I_T. _____
c Determine the value of P_T. _____
d Determine the value of E_{R_L}. _____
e Determine the value of I_{R6}. _____

15. Base your answers to parts a through e on the diagram of the tuned circuit below. [5]



a Determine the value of F_R. _____
b Determine the value of X_L. _____
c Determine the value of Q. _____
d Determine the value of BW. _____
e Determine the value of Z. _____

152 Base your answers to parts a through c on the circuit diagram below. [5]



a Determine the value of R_1. [2] _____

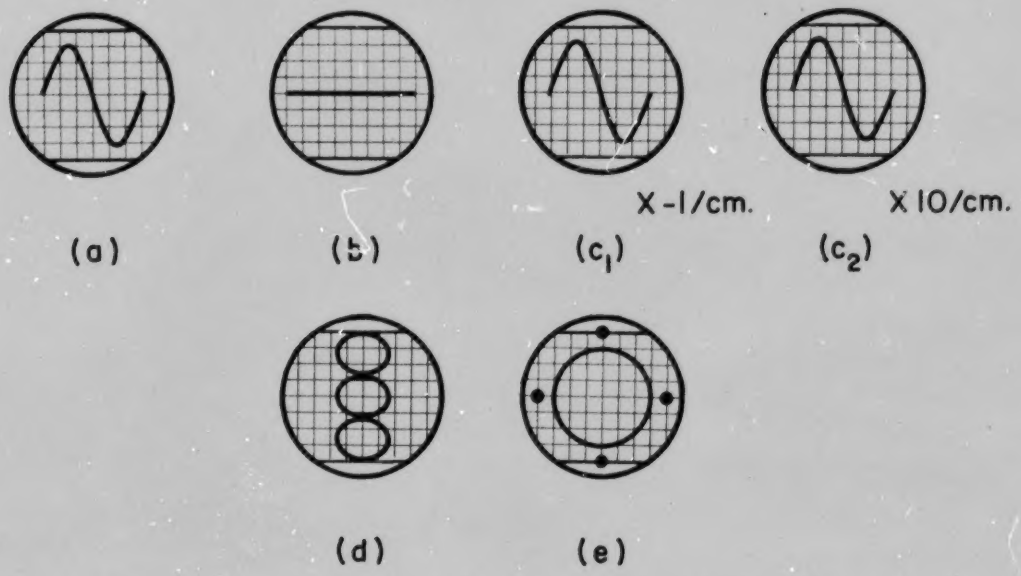
b Determine the total resistance of the circuit. [1] _____

c Determine the voltage across R_3. [2] _____

153 A relay coil with a resistance of 300 ohms is placed in a circuit. If the applied voltage is 115 volts and the current must be limited to 0.25 amp., what value resistor must be placed in series with the coil? [5]

153_____

154 Base your answers to parts a through e on the oscilloscope patterns shown below. [5]



a What is the p-p a.c. voltage of the sine wave in pattern a if the vertical gain is set for x10/centimeters?

b What is the d.c. voltage measurement in pattern b if the vertical gain is set for x1/cm.?

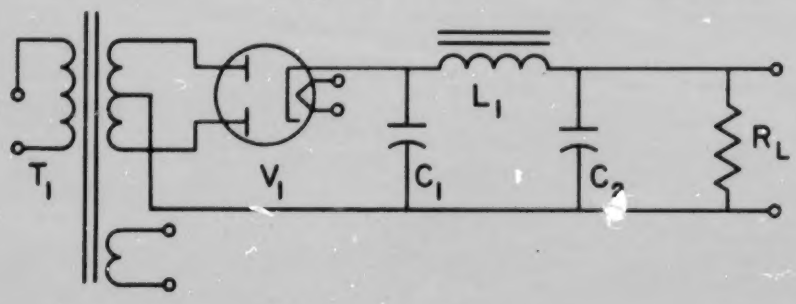
c The input and output signals of an amplifier stage are shown by the patterns C_1 and C_2. What is the gain of the amplifier stage?

d When a frequency of 60 Hz. is applied to the vertical terminals and an unknown frequency is applied to the horizontal terminals, pattern d is produced. What is the unknown frequency?

e In pattern e, what is the phase angle between the voltage and the current?

a _____
b _____
c _____
d _____
e _____

155 Base your answers to parts a through e on the diagram of the power supply shown below. [5]



a What type of power supply is shown in the diagram? _____

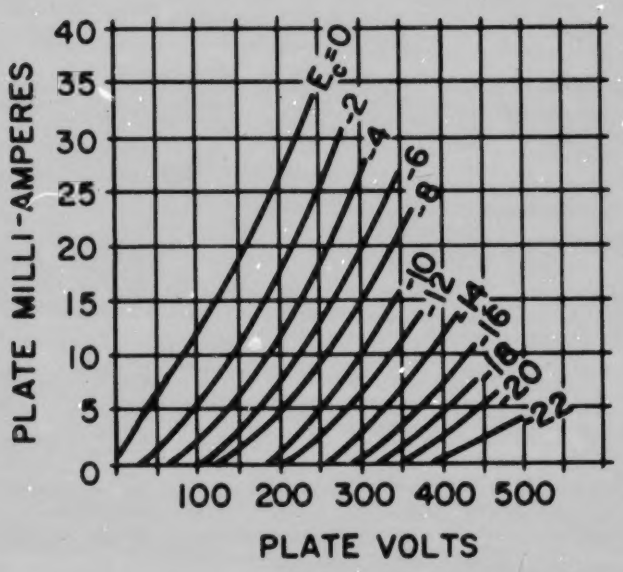
b What is the function of V_1? _____

c What is the function of L_1, C_1, and C_2? _____

d What is one function of R_L? _____

e What is the percentage of voltage regulation of the power supply if the output voltage with no load is 275 volts and under full load is 260 volts? _____

156 The graph below shows the I_bE_b characteristic curves for a type 6FQ7 tube. Base your answers to parts a through e on this graph. [5]



a If the plate current is constant at 20 ma. and the grid voltage changes from 0 to -2 volts, what is the amplification factor of the tube? _____

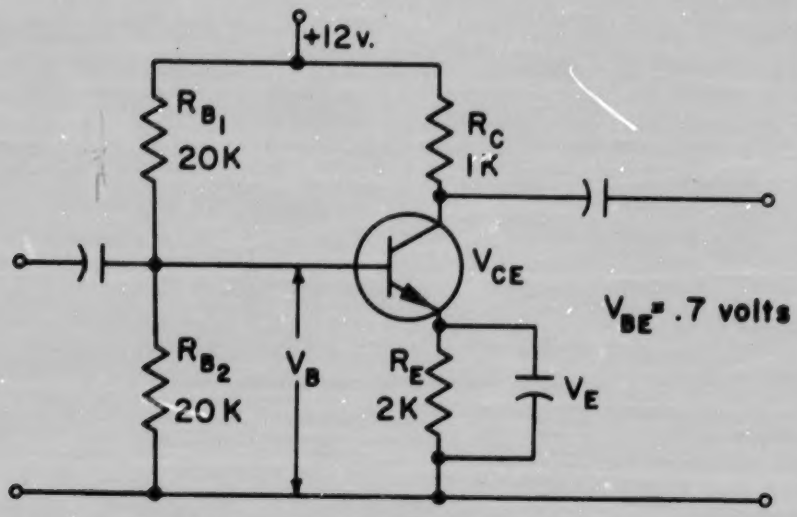
b If the plate voltage changes from 150 to 200 volts and the E_C voltage is constant at -4 volts, what is the a-c plate resistance (r_p) of the tube? _____

c If the plate voltage is 100 volts and E_C changes from 0 to -2 volts, what would be the transconductance of the tube? _____

d If the G_m is 3,000 and the amplification is 20, what would be the r_p of the tube? _____

e If the E_C voltage is -4 and the plate voltage is 200 volts, what is the plate current? _____

157 Base your answers to parts a through e on the diagram of the amplifier circuit below. [5]



a Determine the value of V_B. _____

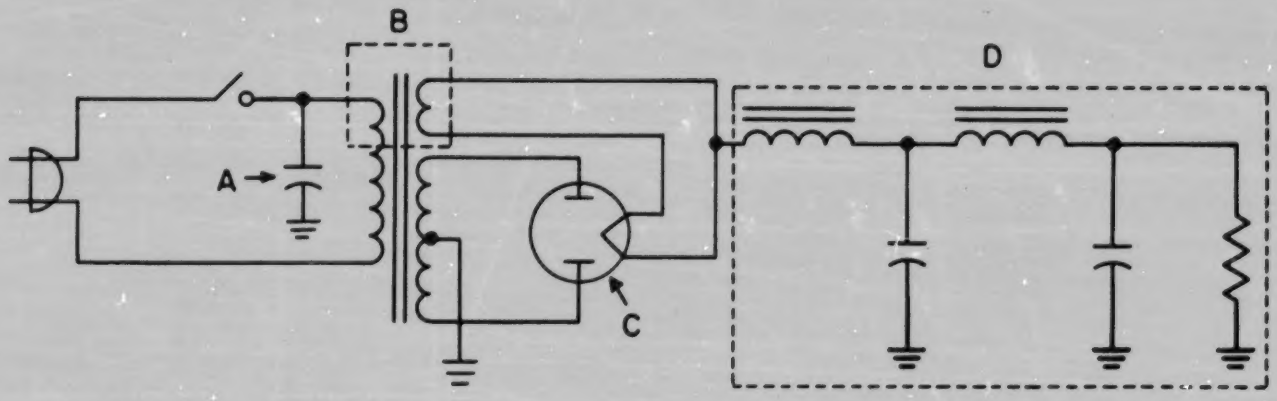
b Determine the value of V_E. _____

c Determine the value of I_E. _____

d Determine the value of I_C. _____

e Determine the value of V_{CE}. _____

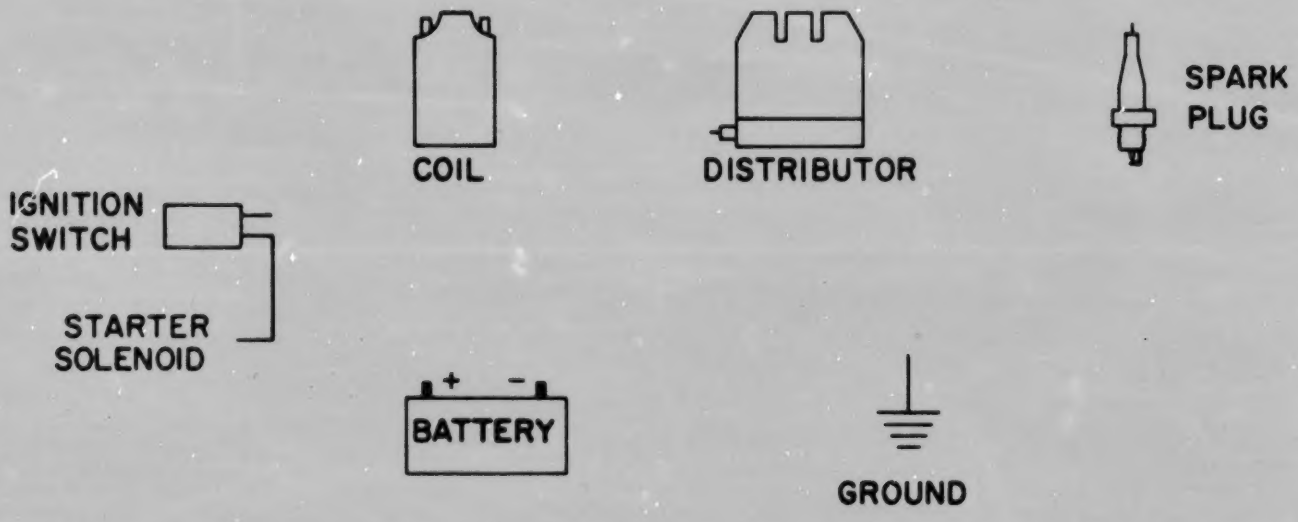
158 Base your answers to parts a through e on the diagram shown below. [5]



a What electrical device is indicated by letter A?
b What is the function of the part of the circuit indicated by letter B?
c What electrical device is indicated by letter C?
d What is the name of the part of the circuit indicated by letter D?
e What does the entire circuit represent?

a _____
b _____
c _____
d _____
e _____

159 Wire the auto ignition circuit shown below. [5]



Industrial Arts Examination Materials

ELECTRICITY and ELECTRONICS

Scoring Key

(1)	1	(41)	2	(81)	2	(121)	1
(2)	2	(42)	1	(82)	3	(122)	4
(3)	4	(43)	2	(83)	4	(123)	2
(4)	2	(44)	3	(84)	3	(124)	4
(5)	1	(45)	2	(85)	3	(125)	3
(6)	3	(46)	3	(86)	2	(126)	4
(7)	2	(47)	4	(87)	2	(127)	4
(8)	2	(48)	1	(88)	3	(128)	3
(9)	4	(49)	2	(89)	2	(129)	1
(10)	4	(50)	4	(90)	4	(130)	1
(11)	3	(51)	3	(91)	3	(131)	4
(12)	3	(52)	1	(92)	1	(132)	4
(13)	1	(53)	1	(93)	3	(133)	3
(14)	4	(54)	3	(94)	4	(134)	2
(15)	1	(55)	1	(95)	2	(135)	1
(16)	4	(56)	2	(96)	1	(136)	1
(17)	1	(57)	1	(97)	2	(137)	2
(18)	3	(58)	4	(98)	3	(138)	3
(19)	4	(59)	1	(99)	3	(139)	4
(20)	1	(60)	3	(100)	4	(140)	2
(21)	4	(61)	1	(101)	1	(141)	1
(22)	3	(62)	3	(102)	1	(142)	2
(23)	2	(63)	4	(103)	3	(143)	3
(24)	3	(64)	3	(104)	2	(144)	1
(25)	4	(65)	2	(105)	1	(145)	1
(26)	1	(66)	3	(106)	3	(146)	4
(27)	2	(67)	1	(107)	1	(147)	3
(28)	1	(68)	2	(108)	4	(148)	4
(29)	2	(69)	2	(109)	2		
(30)	2	(70)	3	(110)	3		
(31)	3	(71)	2	(111)	4		
(32)	3	(72)	3	(112)	2		
(33)	1	(73)	2	(113)	1		
(34)	4	(74)	4	(114)	2		
(35)	2	(75)	2	(115)	2		
(36)	3	(76)	1	(116)	1		
(37)	1	(77)	2	(117)	2		
(38)	2	(78)	4	(118)	2		
(39)	4	(79)	1	(119)	4		
(40)	3	(80)	4	(120)	1		

(149) 2.65 ma.

(150) a 600Ω
b 50 ma.
c 1.5 watts
d 6 volts
e 30 ma.

(151) a 795 MHz.
b 4992.6Ω
c 554.7 or 555
d 14324+Hz.
e 9Ω

(152) a 24Ω
b 8Ω
c 8v

(153) 160Ω

(154) a 60 volts
b 2 volts
c 100
d 180 Hz.
e 90°

(155) a full wave rectifier
b rectify
c filter
d bleeder resistor
e 6%

(156) a u = 30
b r_p = 8333
c g_m = 3000 μ mhos
d r_p = 6666 ohms

(157) a 6 volts
b 5.3 volts
c 2.65 ma.
d 2.65 ma.
e 4.05 volts

(158) a filter cap used to illuminate interference

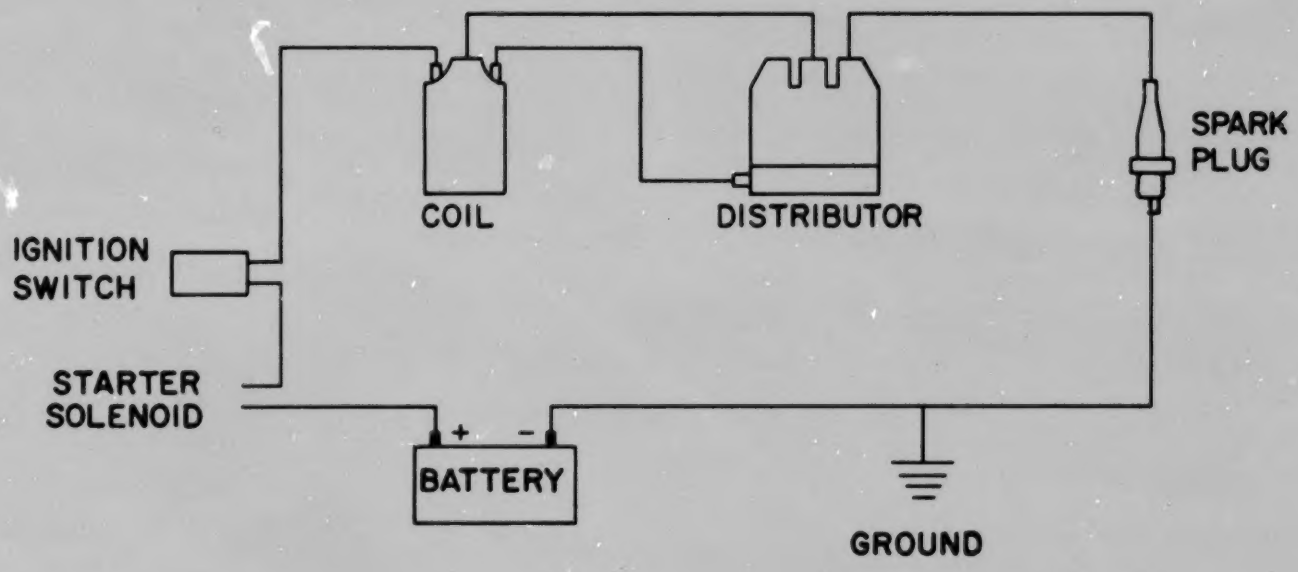
b supplies filament voltage

c full wave rectifier tube

d filter circuit (2 sections)

e full wave rectifier power supply

(159)


SPARK
PLUG
COIL
DISTRIBUTOR
IGNITION
SWITCH
STARTER
SOLENOID
+
-
BATTERY
GROUND

Industrial Arts Examination Materials

POWER MECHANICS

Multiple Choice

Directions (1-146): In the space provided, write the number preceding the word or expression that, of those given, best completes the statement or answers the question.

Part I Small Engines

Unit A. Construction (1-16)

1 What is the soft material used where the connecting rod rides against the crankshaft?

1 brass
2 bronze
3 babbitt
4 copper

1____

2 How many times must the crankshaft revolve in a four-cycle engine to complete one sequence of strokes?

1 once
2 twice
3 three times
4 four times

2____

3 What type of engine completes its functions in one revolution?

(1) Otto cycle
(2) 2-cycle
(3) diesel
(4) 4-cycle

3____

4 How many times must the crankshaft rotate on a small two-cycle engine to complete one cycle of a firing operation?

1 once
2 twice
3 three times
4 four times

4____

5 What happens while the fuel mixture in the cylinder of a small two-cycle gasoline engine is being compressed?

1 The reed valve closes.
2 The transfer port opens.
3 Fuel enters the crankcase.
4 The exhaust is emitted.

5____

6 Most marine outboard engines are of what design?

1 diesel
2 two-cycle
3 four-cycle
4 four-stroke

6_____

7 Most late-model small engines, under five horsepower, have engine blocks made from

1 cast iron
2 manganese
3 zinc
4 aluminum

7_____

8 Which part controls the valve operation on a small four-cycle engine?

1 cam
2 crankshaft
3 distributor
4 governor

8_____

9 What is the bottom piston ring on an engine called?

1 compression ring
2 oil control ring
3 scraper ring
4 snap ring

9_____

10 The engine displacement of American-made engines is measured in

1 inches
2 meters
3 square inches
4 cubic inches

10_____

11 The piston ring gap clearance for a 3.5-inch piston would normaily be

(1) .008 in.
(2) .011 in.
(3) .015 in.
(4) .020 in.

11_____

12 Which stroke takes place when the exploding air-fuel charge pushes the piston down?

1 intake stroke
2 compression stroke
3 power stroke
4 exhaust stroke

12_____

13 In a 4-cycle engine, what are the devices that control the openings that admit and release gases?

1 valves
2 lifters
3 cams
4 ports

13_____

14 In which stroke of a 4-cycle engine does the air-fuel mixture enter the engine?

1 intake
2 compression
3 exhaust
4 power

14_____

15 How much work is done when a weight of 10 pounds is lifted 2 feet?

(1) 5 ft.-lb.
(2) 8 ft.-lb.
(3) 12 ft.-lb.
(4) 20 ft.-lb.

15_____

16 Which parts should always be tightened with a torque wrench when a small engine is assembled?

1 flywheel nut and carburetor flange
2 connecting rod cap screws and head bolts
3 crankcase cap screws and muffler nuts
4 spark plug and magneto point screws

16_____

Unit B. Fuel Systems (17-23)

17 What is the name of the circular disc in the air horn of a carburetor that controls the amount of air and fuel entering the engine?

1 throttle valve
2 compensating valve
3 check valve
4 acceleration valve

17_____

18 In which part of the carburetor are the air and fuel mixed together?

1 air horn
2 nozzle
3 float chamber
4 venturi

18_____

19 The basic action of a carburetor is based on the principles of fluids in motion that were discovered in the 18th century by

1 Pascal
2 Bernoulli
3 Stromboli
4 Torricelli

19_____

20 What produces the vacuum in a carburetor air horn?

1 fuel nozzle
2 venturi
3 float
4 jets

20____

21 On most small, two-cycle gasoline engines, the fuel mixture enters the crankcase through the

1 reed valve
2 bypass port
3 intake port
4 intake valve

21____

22 Which part is supposed to keep an engine from exceeding a certain r.p.m.?

1 throttle
2 flywheel
3 governor
4 linkage

22____

23 Which ingredient is present in the fuel for a 2-cycle engine that is not present in the fuel for a 4-cycle engine?

1 detergents
2 kerosene
3 oil
4 gasoline

23____

Unit C. Lubrication (24-31)

24 Which type of rod and main bearings would most likely be used in a small two-cycle gasoline engine?

1 insert
2 ball or roller
3 oilless
4 cast aluminum

24____

25 Oils are graded or numbered according to their

1 porosity
2 viscosity
3 thermosity
4 tenacity

25____

26 Most small four-cycle gasoline engines are lubricated by

1 the splash system
2 bearing throwoff
3 a gear-type oil pump
4 oil mixed with the gasoline

26____

27 Which system is used to lubricate the internal parts on most small one-cylinder engines?

1 bypass
2 splash
3 filter
4 circulating

27____

28 In an engine, the friction between metal surfaces is reduced by using

1 water
2 oil
3 grease
4 antifreeze

28____

29 The fuel for a small two-cycle gasoline engine should be a mixture of gasoline and

1 kerosene
2 diesel oil
3 lubricating oil
4 alcohol

29____

30 Oil is mixed with the gasoline in order to lubricate the internal parts of most

(1) rotating combustion engines
(2) 2-cycle gasoline engines
(3) diesel engines
(4) 4-cycle gasoline engines

30____

31 Which type of oil should be used for 2-cycle gasoline engines?

1 high detergent oil
2 multiviscosity oil
3 nondetergent or SA oil
4 castor oil

31___

Unit D. Cooling Systems (32-39)

32 In air-cooled engines, most of the heat produced by the engine is transferred into the air by the cooling

1 ducts
2 fins
3 vanes
4 shrouds

32____

33 On a small air-cooled engine, the largest and most numerous cooling fins are found

1 near the engine crankcase
2 around the intake valve
3 at the top of the cylinder
4 near the magneto

33____

34 If the fins on an air-cooled engine become clogged, the engine will most likely

1 not start
2 burn oil
3 overheat
4 stall easily

34____

35 On most air-cooled engines, air is forced past the engine by

1 the exhaust gases
2 fins on the flywheel
3 the carburetor
4 the magneto

35____

36 The sheetmetal shrouds on an air-cooled engine

1 hold the engine together
2 streamline the engine for higher speeds
3 make the engine look larger and more powerful
4 direct the flow of air for maximum cooling efficiency

36____

37 The primary purpose of the shroud on an air-cooled engine is to

1 provide a decorative cover
2 direct the flow of air
3 protect the operator from moving parts
4 provide a safety cover for the heat radiating fins

37____

38 What would happen if a small air-cooled engine is set at too low an idle speed and left to run at that idle speed for a long period of time?

1 The spark plug would foul.
2 The engine would overheat.
3 The oil would be used up.
4 The points would burn. 38____

39 Where is an impeller-type water pump located in most marine outboard engines?

1 in the lower gear housing
2 behind the power head
3 in the flywheel
4 midway in the drive unit 39____

Unit E. Ignition Systems (40-55)

40 In a two-cycle engine, the ignition system supplies a high voltage surge to the spark plug toward the end of which stroke?

1 intake
2 compression
3 power
4 exhaust 40____

41 Which device produces the electricity needed to fire the spark plug in small engines?

1 battery
2 magneto
3 electromagnet
4 governor 41____

42 The gap of a spark plug should be checked with a

1 wire gauge
2 cam angle meter
3 flat feeler gauge
4 micrometer 42____

43 After cleaning a spark plug, it should be regapped by

1 filing the ground electrode
2 bending the ground electrode
3 filing the center electrode
4 bending the center electrode 43____

44 Spark plugs which are fouled with carbon deposits should be

1 scraped with a knife
2 tapped with a hammer
3 held over a flame
4 cleaned in a sand blaster

44____

45 It is especially important on small air-cooled engines to use a spark plug with the proper

1 color
2 ceramic composition
3 heat range
4 compression ratio

45____

46 Which type of spark plug is used in many late-model outboard engines?

1 multi-electrode
2 glow plug
3 surface gap
4 extended nose

46____

47 A very important and often overlooked adjustment in the magneto ignition assembly of many small air-cooled engines is the setting of the armature

1 timing
2 magnetism
3 air vane
4 air gap

47____

48 In many late-model four- and six-cylinder marine outboard engines, the magneto ignition system has been replaced by

1 a capacitor discharge ignition system
2 an alternator
3 an automotive distributor
4 a glow plug

48____

49 A magneto ignition system is different from a battery ignition system in that the magneto ignition system

1 uses two sets of points
2 does not use a condenser
3 needs a larger spark plug
4 does not contain a source of stored electricity

49____

50 When magneto breaker points are being set on a small engine, the crankshaft should be rotated in the forward direction until the points are

1 fully closed
2 just starting to open
3 halfway open
4 open to their widest gap 50____

51 Which component fires the air-fuel mixture in a gasoline engine?

1 ignition point
2 ignition coil
3 spark plug
4 condenser 51____

52 What should be the color of properly working ignition points?

1 black
2 blue
3 white
4 gray 52____

53 The coil used by an ignition system to obtain its high voltage acts as a

1 step-up transformer
2 high voltage transformer
3 stepdown transformer
4 low voltage transformer 53____

54 Which type of ignition system is used on most one-cylinder engines?

1 transistor
2 ignition coil
3 transformer
4 flywheel magneto 54____

55 Some small air-cooled gasoline engines contain a special soft flywheel key. If this key is partially sheared or distorted, it will affect the

1 ignition timing
2 flywheel balance
3 valve timing
4 engine cooling 55____

Unit F. Care and Maintenance (56-62)

56 Which test is made by giving the flywheel on a small engine a quick spin?

1 main bearing test
2 compression test
3 governor test
4 air cleaner test

56____

57 The fuel tank should be drained and the carburetor should always be run dry on a small engine that is to be

1 left outdoors overnight
2 stored for several months
3 tuned up
4 used for racing

57____

58 The fins and sheetmetal shrouds on a small two- or four-cycle gasoline engine should always be kept clean of grass, dirt, and oil in order to

1 avoid flooding the engine
2 prevent excessive fuel consumption
3 provide adequate cooling
4 avoid hard starting

58____

59 How often should the air filter on a small gasoline engine used on a lawnmower or garden tractor be cleaned?

1 during tuneups, only
2 whenever it is dirty
3 once a year
4 every ten hours

59____

60 What should always be done to an outboard engine after it is run in salt water?

1 Flush the cooling system.
2 Drain the gas tank.
3 Change the crankcase oil.
4 Clean the spark plugs.

60____

61 Which material should be put into the cylinder of an engine that is being stored for several months?

1 kerosene
2 liquid wrench
3 oil
4 gas

61____

62 Which part of the exhaust fumes is odorless, colorless, and a deadly poison?

1 carbon dioxide
2 carbon monoxide
3 hydrogen
4 nitrogen

62____

Unit G. Power Transmission (63-68)

63 Which parts are used to transmit power from one sprocket to another sprocket?

1 belts
2 universals
3 gears
4 chains

63____

64 Which component is used to engage and disengage an engine from its running gear?

1 brake
2 choke
3 throttle
4 clutch

64____

65 Which device automatically couples and uncouples an engine from the transmission when starting and stopping?

1 slip clutch
2 Prony brake
3 centrifugal clutch
4 cog belt

65____

66 What type of gearing is used in the lower unit of an outboard engine?

1 spur
2 planetary
3 bevel
4 worm

66____

67 Which type of simple machine is a gear?

1 lever
2 wheel
3 screw
4 incline plane

67____

68 The total force required to bring a crankshaft to a dead stop is

1 engine r.p.m.
2 engine torque
3 engine horsepower
4 brake horsepower

68____

Unit H. Industry and Careers (69-73)

69 Where can a person find information about careers in small engine or outboard engine sales and service?

1 the yellow pages
2 the encyclopedia
3 Occupational Outlook Handbook
4 the dictionary

69____

70 The trade name "Wisconsin," "Kohler," or "Briggs & Stratton," on a piece of equipment indicates that it is powered by a

(1) electric motor
(2) 2-cycle engine
(3) liquid cooled engine
(4) 4-cycle engine

70____

71 The trade name "Jacobsen," "Lawn Boy," or "Tecumseh," on a piece of equipment indicates that it is powered by a

(1) electric motor
(2) 2-cycle engine
(3) liquid cooled engine
(4) 4-cycle engine

71____

72 The first one or two numbers in the serial number of a Briggs & Stratton engine indicate its approximate

1 horsepower
2 displacement in cubic inches
3 weight
4 torque

72____

73 The persons responsible for developing and designing a new engine are the

1 management personnel
2 industrial designers
3 engineers
4 technicians

73____

Part II Vehicle Power

Unit A. Gasoline Engines (74-96)

74 How many crank throws does a 6-cylinder in-line engine have?

(1) 6 (3) 3
(2) 8 (4) 4 74____

75 What is the name given to the amount of time the ignition points stay closed as the cam revolves?

(1) point opening (3) r.p.m.
(2) dwell angle (4) point pressure 75____

76 Late ignition timing will cause

1 a loss of power 3 increased power
2 engine knock 4 detonation 76____

77 There is a good spark from the secondary of the ignition coil, but the spark is not reaching the spark plugs. It is most likely that the malfunction is located in the

1 primary wiring 3 ignition switch
2 points or condenser 4 distributor cap or rotor
77____

78 During which season is an automotive radiator pressure cap most useful?

1 summer 3 winter
2 fall 4 spring 78____

79 What type of lubrication system is used to oil the bearings in modern multiple-cylinder engines?

1 full force feed 3 bypass
2 splash 4 pressure 79____

80 How efficient is the modern gasoline engine?

(1) 5% to 10%
(2) 10% to 15%
(3) 15% to 25%
(4) 25% to 30%

80____

81 Which process is used to obtain a gastight seal between the valve and valve seat in a gasoline engine?

1 lapping
2 grinding
3 filing
4 polishing

81____

82 Which tool is used in a repair shop to measure crankshaft journals?

1 telescoping gauge
2 go/no-go gauge
3 calipers
4 micrometer

82____

83 Which engine part changes reciprocating motion to rotary motion?

1 camshaft
2 connecting rod
3 crankshaft
4 piston

83____

84 Which engine part is considered to be part of the basic frame of an engine?

1 crankcase
2 cylinder block
3 cylinder head
4 crankshaft

84____

85 Which part of a vehicle changes chemical energy to electrical energy?

1 generator
2 battery
3 alternator
4 regulator

85____

86 Which device in the cooling system keeps an engine at a constant operating temperature?

1 water pump
2 temperature gauge
3 thermostat
4 radiator

86____

87 Which device recharges the battery in a car?

1 carburetor
2 alternator
3 distributor
4 starter

87_____

88 Which type of bearing supports a revolving shaft?

1 guide
2 journal
3 thrust
4 sliding friction

88_____

89 The ignition timing of a car is adjusted by turning the

1 flywheel
2 rotor
3 distributor
4 carburetor

89_____

90 The fuel level in a carburetor is controlled by the

1 metering rod
2 accelerator pump
3 float
4 jets

90_____

91 The escape of burned gases from the combustion chamber past the pistons and into the crankcase is called

1 blow-by
2 bypass
3 gas loss
4 leakdown

91_____

92 The magnets in a starter motor are called

1 armatures
2 fields
3 brushes
4 slip rings

92_____

93 The electrolyte in a storage battery is made of water and

1 ammonia
2 alcohol
3 hydrochloric acid
4 sulphuric acid

93_____

94 The most common automotive engine valve seat angles are

(1) 15° and 60°
(2) 20° and 40°
(3) 30° and 45°
(4) 60° and 90°

94_____

95 Which cylinder block design is used on many 8-cylinder engines?

(1) Y
(2) V
(3) opposed
(4) radial

95____

96 The ignition distributor centrifugal advance mechanism advances the timing of a vehicle when

1 the brakes are suddenly applied
2 the engine speed is increased
3 the car is started in cold weather
4 high-octane gasoline is being burned

96____

Unit B. Diesel Engines (97-105)

97 In which type of engine is the fuel charge fired by the heat of compression?

1 diesel
2 gasoline
3 outboard
4 steam

97____

98 What do diesel engines use to force air into the cylinders?

1 pump
2 compressor
3 blower
4 injector

98____

99 What does a diesel engine use in place of a carburetor?

1 an injector
2 a blower
3 a compressor
4 a fuel filter

99____

100 What is the average compression ratio in a diesel engine?

(1) 32:1
(2) 18:1
(3) 8:1
(4) 4:1

100____

101 In a diesel engine, the fuel and air are mixed in the

1 carburetor
2 intake manifold
3 blower
4 cylinders

101____

102 Which type of pump forces fuel into the cylinders of a diesel engine?

1 fuel
2 injection
3 water
4 vacuum

102____

103 One difference between a two- and four-cycle diesel engine is that the two-cycle engine has

1 two carburetors
2 a larger intake valve
3 a blower and ports
4 a smaller spark plug

103____

104 In the diesel engine, fuel is injected into the cylinder at the end of which stroke?

1 intake
2 compression
3 power
4 exhaust

104____

105 Diesel fuel is most similar to

1 gasoline
2 mineral spirits
3 benzine
4 kerosene

105____

Unit C. Rotary Engines (106-112)

106 The gas turbine engine is most often used in

1 commuter vehicles
2 stop-start delivery service
3 short haul trucks
4 long distance express trucks and buses

106____

107 The four basic parts of an automotive gas turbine engine are the

1 compressor, burner, turbine, reduction gear
2 injector, compressor, burner, pump
3 turbine, compressor, rotor, stator
4 turbine, free piston, burner, rotor

107____

108 Compared to a gasoline engine, a gas turbine with the same horsepower rating will

1 weigh more
2 produce more excess heat
3 vibrate more
4 use less fuel 108____

109 Who was the original inventer and developer of the rotating combustion engine?

1 Curtis-Wright
2 Chevrolet Motor Co.
3 Felix Wankel
4 Mazda 109____

110 The Wankel engine does not have a

1 lubricating system
2 cooling system
3 ignition system
4 valve system 110____

111 In place of a piston, rotary engines use a

1 field
2 rotor
3 stator
4 commutator 111____

112 Which is the simplest type of rotary engine?

1 Wankel
2 turbo jet
3 gas turbine
4 turbo fan 112____

Unit D. Maintenance (113-124)

113 The paint on a vehicle should be protected by applying a coat of

1 wax
2 varnish
3 thinner
4 tar remover 113____

114 The ignition primary circuit is working, but there is no spark at the coil secondary. This problem is most likely caused by a defective

1 rotor
2 distributor cap
3 set of points
4 coil 114____

115 A dirty carburetor air cleaner could cause

1 too rich a fuel mixture
2 too lean a fuel mixture
3 detonation
4 dieseling

115____

116 The main ingredient of permanent antifreeze is

1 alcohol
2 methanol
3 ethylene glycol
4 sodium propionate

116____

117 A battery is tested under load with a voltmeter. The battery will not stand up under normal use if any cell tests below

(1) 1.0 volt
(2) 2.0 volts
(3) 1.5 volts
(4) 12 volts

117____

118 The corrosion on a battery may be cleaned by using water and

1 baking soda
2 acetic acid
3 baking powder
4 a detergent

118____

119 If a battery needs water added quite often, a check should be made of the

1 battery capacity
2 battery charge
3 generating system
4 tension of the fan belt

119____

120 In the lubrication system, waste materials in the oil are collected by the

1 screen in the oil sump
2 oil filter
3 oil pump
4 oil gallery

120____

121 Before air enters the engine, it should pass through the

1 gas filter
2 oil filter
3 air filter
4 air strainer

121____

122 What should be done first if a brake pedal feels spongy when it is pressed?

1 Check the wheel cylinder.
2 Adjust the brakes.
3 Replace the brakes.
4 Check the master cylinder. 122____

123 Which material is put in the master cylinder?

1 oil
2 grease
3 water
4 brake fluid 123____

124 When a small amount of oil is added to a cylinder, the compression pressure increases. This indicates that there is leakage past the

1 valves
2 head gasket
3 piston rings
4 guides 124____

Unit E. Power Transmission (125-140)

125 Which system in an automobile operates according to the principle of hydraulics?

1 lubricating
2 cooling
3 brake
4 fuel 125____

126 What does a mechanic remove from the brake lines when he bleeds a hydraulic brake system?

1 dirt
2 air
3 water
4 extra brake fluid 126____

127 Spongy brakes are usually caused by

1 air in the lines
2 worn brake linings
3 glazed brake linings
4 oil-soaked brake linings 127____

128 A car swerves to the right when the brakes are applied. This problem is most likely caused by

1 an unequal fluid pressure on the two sides
2 an improperly adjusted master cylinder linkage
3 foreign material on one of the brake linings
4 a leak in the master cylinder 128____

129 Which gears are located in the planetary gear system of an automatic transmission?

1 sun, hypoid, and ring gears
2 sun, planet pinion, and ring gears
3 planetary, ring, and pinion gears
4 planetary, hypoid, and external gears 129____

130 Two meshed gears have a ratio of 4:1. This means that while the large gear is turning five times, the small gear will turn

(1) $\frac{4}{5}$ of a turn (3) 10 times

(2) $\frac{5}{4}$ of a turn (4) 20 times 130____

131 Two meshed gears have a gear ratio of 3:1. Each time the smaller gear turns once, the larger gear will turn

(1) once (3) 3 times

(2) twice (4) $\frac{1}{3}$ of a turn 131____

132 Which type of gear can transmit power between two shafts that form an angle of 90°?

1 spur 3 helical
2 rack 4 bevel 132____

133 One gear has twice as many teeth as a second gear. The mechanical advantage of the two gears is

(1) 1 (3) 3

(2) $\frac{1}{2}$ (4) 4 133____

134 A gear turning at 500 r.p.m. with 60 teeth on it, turns a second gear with 15 teeth. How many r.p.m. does the second gear turn?

(1) 75 r.p.m.
(2) 250 r.p.m.
(3) 2,000 r.p.m.
(4) 2,500 r.p.m.

134____

135 What is used to transmit power between two shafts that are not always exactly in line?

1 worm gear
2 bevel gear
3 universal joint
4 ball joint

135____

136 The purpose of a shock absorber is to

1 support the vehicle's weight
2 retard spring action
3 absorb road shock directly
4 raise the vehicle's center of gravity

136____

137 Which parts of the propeller shaft compensate for the change in the driving angle as the differential moves up and down?

1 slip joints
2 flanges
3 universal joints
4 splines

137____

138 Which part of a torque converter reflects oil back to aid the pump?

1 stator
2 turbine
3 pump
4 clutch

138____

139 If operated correctly, overdrive transmissions help save on gas by

1 giving more power on hills
2 providing a passing gear
3 providing a freewheeling device
4 decreasing engine speed in relation to wheel speed

139____

140 The clutch disc is forced against the flywheel by the

1 housing
2 torsion coils
3 clutch release bearing
4 pressure plate

140____

Unit F. Industrial Organization (141-146)

141 The system of inspection in which parts are checked at many points along the production line is called

1 preventive maintenance
2 quality control
3 sampling
4 spot checking

141____

142 The idea of "interchangeable parts" is usually credited to

1 Henry Ford
2 Frank Lloyd Wright
3 John D. Rockefeller
4 Eli Whitney

142____

143 Which occupational group is one of the largest in the United States?

1 taxi drivers
2 truck drivers
3 racing drivers
4 chauffeurs

143____

144 Which of the following jobs is done by a factory employee?

1 technical teacher
2 assembly inspector
3 automotive dealership
4 truck driver

144____

145 A person who examines a car which has been in an accident and determines the cost of repairs is

1 an insurance adjuster
2 an insurance representative
3 a service manager
4 an automotive dealer

145____

146 A mechanic who becomes an expert in one phase of repair work is called

1 an auto mechanic
2 a specialty mechanic
3 a shop foreman
4 a service manager

146____

Group Questions (147-151)

147 Name the five circuits of a carburetor and briefly tell how each operates. [5]

a _____

_____

b _____

_____

c _____

_____

d _____

_____

e _____

_____

148 a List two ways in which oil can enter the combustion chamber and be burned. [2]

1 _____

_____

2 _____

_____

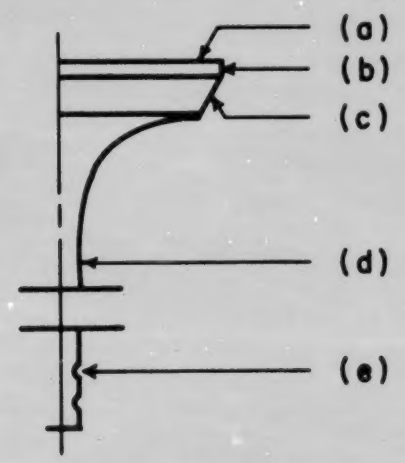
b List three ways in which oil can leak out of an engine without being burned. [3]

1 _____

2 _____

3 _____

149 For <u>each</u> of parts <u>a</u> through <u>e</u> in the diagram of the valve shown below, write in the space provided the <u>name</u> of the part of the valve that is indicated by that letter. [5]



<u>a</u> _____

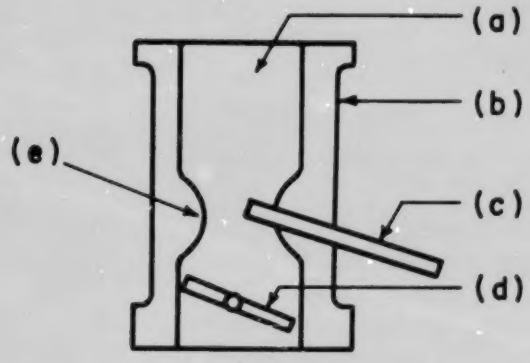
<u>b</u> _____

<u>c</u> _____

<u>d</u> _____

<u>e</u> _____

150 For <u>each</u> of parts <u>a</u> through <u>e</u> in the diagram below, write in the space provided the <u>name</u> of the part of the simple carburetor that is indicated by that letter. [5]



<u>a</u> _____

<u>b</u> _____

<u>c</u> _____

<u>d</u> _____

<u>e</u> _____

151 On the line at the left of each measuring instrument listed in parts a through e, write the number of the type of measurement, chosen from the list below, that would be made by that instrument. [5]

Measurements

(1) Bearing clearance
(2) Cylinder bore diameter
(3) Tappet clearance
(4) Spark plug gap
(5) Strength of battery electrolyte
(6) Ignition point gap
(7) Crankshaft journal clearance

_____ a feeler gauge

_____ b inside micrometer

_____ c hydrometer

_____ d plastigage

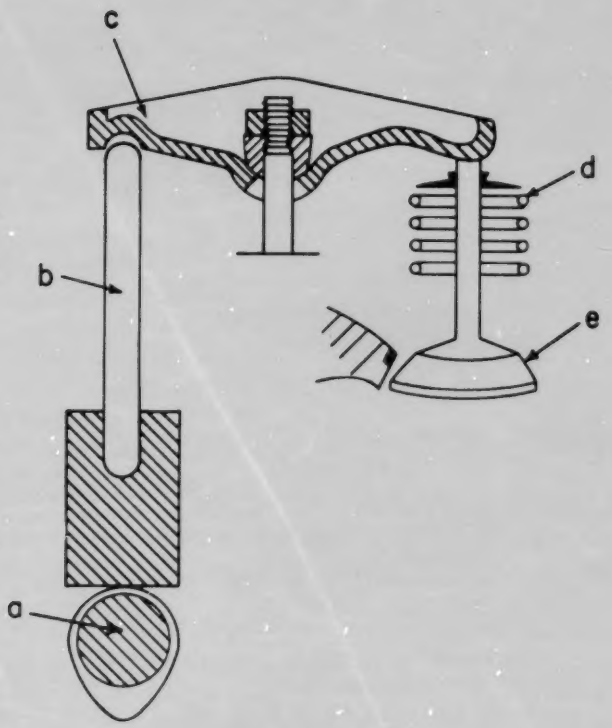
_____ e dwell angle meter

152 On the line at the left of parts a through e, write the number of the valve-linkage part, chosen from the list below, that is indicated by that letter in the diagram. [5]

Valve-Linkage Parts

(1) Gear block
(2) Rocker arm
(3) Valve
(4) Oil plunger
(5) Camshaft
(6) Pushrod
(7) Cam bearing
(8) Valve spring

_____ a
_____ b
_____ c
_____ d
_____ e



Industrial Arts Examination Materials

POWER MECHANICS

Scoring Key

(1)	3	(31)	3	(61)	3	(91)	1
(2)	2	(32)	2	(62)	2	(92)	2
(3)	2	(33)	3	(63)	4	(93)	4
(4)	1	(34)	3	(64)	4	(94)	3
(5)	3	(35)	2	(65)	3	(95)	2
(6)	2	(36)	4	(66)	3	(96)	2
(7)	4	(37)	2	(67)	1	(97)	1
(8)	1	(38)	2	(68)	4	(98)	3
(9)	2	(39)	4	(69)	3	(99)	1
(10)	4	(40)	2	(70)	4	(100)	2
(11)	2	(41)	2	(71)	2	(101)	4
(12)	3	(42)	1	(72)	2	(102)	2
(13)	1	(43)	2	(73)	3	(103)	3
(14)	1	(44)	4	(74)	1	(104)	2
(15)	4	(45)	3	(75)	2	(105)	4
(16)	2	(46)	3	(76)	1	(106)	4
(17)	1	(47)	4	(77)	4	(107)	1
(18)	4	(48)	1	(78)	1	(108)	2
(19)	2	(49)	4	(79)	1	(109)	3
(20)	2	(50)	4	(80)	3	(110)	4
(21)	1	(51)	3	(81)	1	(111)	2
(22)	3	(52)	4	(82)	4	(112)	2
(23)	3	(53)	1	(83)	3	(113)	1
(24)	2	(54)	4	(84)	2	(114)	4
(25)	2	(55)	1	(85)	2	(115)	1
(26)	1	(56)	2	(86)	3	(116)	3
(27)	2	(57)	2	(87)	2	(117)	3
(28)	2	(58)	3	(88)	2	(118)	1
(29)	3	(59)	2	(89)	3	(119)	3
(30)	2	(60)	1	(90)	3	(120)	2

(121) 3
(122) 4
(123) 4
(124) 3
(125) 3
(126) 2
(127) 1
(128) 3
(129) 2
(130) 4
(131) 4
(132) 4
(133) 2
(134) 3
(135) 3
(136) 2
(137) 3
(138) 1
(139) 4
(140) 4
(141) 2
(142) 4
(143) 2
(144) 2
(145) 1
(146) 2

(147) Allow any order:
a idle circuit - runs engine during low r.p.m.'s
b high speed circuit - operates engine at speeds over 20 m.p.h.
c choke circuit - enriches mixture for starting purposes
d float circuit - keeps fuel at correct level for proper operation of carburetor
e acceleration circuit - gives extra fuel necessary for engine to speed up quickly

(148) a 1. through the intake valve guides
2. through the piston rings

b 1. through the valve cover gasket
2. through a rear oil seal
3. through the timing gear cover

(149) a head
b margin
c face
d stem
e valve locks

(150) a air horn
b body
c fuel nozzle
d throttle plate
e venturi

(151) a 3
b 2
c 5
d 1
e 6

(152) a 5
b 6
c 2
d 8
e 3

Industrial Arts Examination Materials

WOODS

Directions (1-160): In the space provided, write the number preceding the word or expression that, of those given, best completes the statement or answers the question.

Part I Wood Products

Unit A. Design and Planning (1-9)

1 What part of an object would the following line represent in a working drawing?

1 a visible edge of an object
2 a hidden edge of an object
3 the center of an object
4 a break in an object 1_____

2 What part of an object would the following line represent in a working drawing?

1 a visible edge of an object
2 a hidden edge of an object
3 the center of an object
4 a break in an object 2_____

3 What part of an object would the following line represent in a working drawing?

1 a visible edge of an object
2 a hidden edge of an object
3 the center of an object
4 a break in an object 3_____

4 Which type of balance is created when a vertical line is drawn through the center of an object and divides it into two equal halves?

1 contemporary
2 formal
3 informal
4 traditional

4_____

5 Which set of measurements would be correct lengths for the right triangle used to lay out a 90° corner for a building?

(1) 6 × 7 × 8
(2) 2 × 4 × 8
(3) 3 × 4 × 5
(4) 7 × 8 × 9

5_____

6 The three keys to a good design are

1 appearance, color, and texture
2 balance, harmony, and rhythm
3 lines, shape, and mass
4 function, appearance, and sound construction

6_____

7 In the principles of design, the "golden mean" rectangle is considered to have the most nearly perfect proportion. The golden mean rectangle proportion is

(1) 2 × 3
(2) 3 × 5
(3) 5 × 8
(4) 8 × 12

7_____

8 A small object that is constructed to scale and shows what the full-sized product will look like is called a

1 form
2 model
3 mold
4 pattern

8_____

9 When designing a piece of furniture, what is the most important fact to consider?

1 the appearance of the furniture
2 the function of the furniture
3 the construction techniques that will be used
4 the materials to be used

9_____

Unit B. Hand Tools and Fixed Machines (10-30)

10 Which type of handsaw would be used for cutting fitted wood joints?

1 backsaw
2 compass saw
3 ripsaw
4 coping saw

10_____

11 Which type of saw blade can be used for the greatest variety of sawing operations?

1 rip
2 planer
3 crosscut
4 combination

11_____

12 Which type of saw would be best for crosscutting boards that are 10 feet or more in length?

1 band
2 radial arm
3 table
4 jig

12_____

13 Which type of saw should be used for internal cutting?

1 bandsaw
2 table saw
3 radial saw
4 jigsaw

13_____

14 How far should the top of a circular saw blade be above the stock?

(1) 1/32 in. to 1/16 in.
(2) 1/8 in. to 1/4 in.
(3) 1/2 in. to 3/4 in.
(4) 3/4 in. to 1 in.

14_____

15 How many 1/4-inch-thick boards can be sawed from a 1 1/4-inch-thick board if all surfaces are to be planed?

(1) 5
(2) 2
(3) 3
(4) 4

15_____

16 Bench rules, try squares, combination squares, sliding T-bevels, dividers, trammel points, and scratch awls are all classified as

1 cutting tools
2 layout tools
3 leveling tools
4 machine tools

16_____

17 Planes, chisels, surform tools, rasps, draw knives, gouges, spokeshavers, and hand and cabinet scrapers are all classified as

1 cutting tools
2 finishing tools
3 sawing tools
4 testing tools

17_____

18 Ripsaws, crosscut saws, coping saws, backsaws, miter box saws, dovetail saws, compass saws, and hacksaws are all classified as

1 layout tools
2 shaving tools
3 leveling tools
4 cutting tools

18_____

19 Auger bits, expansion bits, forstner bits, twist drills, braces, hand drills, and automatic drills are all classified as

1 cutting tools
2 accessory tools
3 drilling and boring tools
4 forming tools

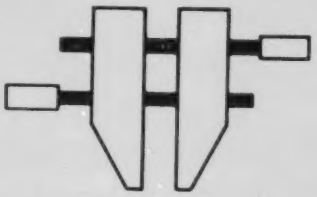
19_____

20 Which type of sander should always be tracked before use?

1 belt
2 disc
3 drum
4 finishing

20_____

21 Which type of clamp is shown below?



(1) C-clamp
(2) bar clamp
(3) spring clamp
(4) parallel clamp

21_____

22 The best way to cut dados with a router is to

1 use a bit with a pilot
2 use an edge guide
3 use a dovetail template
4 cut freehand

22_____

23 Which machine should be used to dovetail the ends of boards when forming the corners of drawers?

1 table saw
2 bandsaw
3 router
4 drill press

23_____

24 The router bit shown below would be used to

1 make rabbet joints
2 make dovetail joints
3 cut beading
4 cut coves

24_____

25 Which tool should not be used in a drill press?

1 twist drill
2 power bit
3 machine spur bit
4 auger bit with threaded point

25_____

26 Which tool should be used to bore a blind flat-bottomed hole in a thin piece of wood?

1 forstner bit
2 power bit
3 machine spur bit
4 twist drill

26_____

27 Which instrument is usually used to scribe circles on a board?

1 divider
2 inside caliper
3 outside caliper
4 hermaphrodite caliper

27_____

28 The best type of square to purchase for a starting set of hand tools would be a

1 try square
2 combination square
3 framing square
4 sliding T-bevel

28_____

29 What is the shortest piece of stock that can safely be used in a jointer?

(1) 7 in.
(2) 12 in.
(3) 16 in.
(4) 18 in.

29_____

30 Which type of hand plane should be used when planing the edge of a board that is six feet or more in length?

1 block plane
2 jack plane
3 jointer plane
4 rabbet plane

30_____

Unit C. Forestry (31-44)

31 Laminating, as done in the manufacture of plywood, is the process of gluing two or more layers of wood together in order to obtain the proper

1 weight
2 length
3 thickness
4 shape

31_____

32 Bending is a method of producing wood parts that must have a

1 flat surface
2 trueness
3 straight edge
4 sharp curvature

32_____

33 Wood is veneered in order to

1 make it stronger
2 make it look more expensive
3 change its color
4 hide defects

33_____

34 Which two types of trees supply most of our lumber?

1 softwood and hardwood
2 broadleaves and deciduous
3 conebearing and coniferous
4 fir and pine

34_____

35 Which wood is <u>least</u> resistant to decay caused by moisture?

1 redwood
2 sugar pine
3 red cedar
4 cypress

35_____

36 Which hardwood has an open grain?

1 cherry
2 maple
3 rosewood
4 oak

36_____

37 New cell formation takes place in the part of a tree called the

1 pith
2 bark
3 wood rays
4 cambium layer

37_____

38 The three main parts of a tree are the

1 bark, branches, and leaves
2 crown, trunk, and roots
3 sapwood, hartwood, and annular rings
4 trunk, crown, and leaves

38_____

39 The standard dimensions of lumber are given in terms of

(1) T × L × W
(2) T × W × L
(3) L × W × T
(4) W × T × L

39_____

40 How many board feet are there in a 3/4-in. × 12-in. × 20-ft. piece of stock?

(1) 10
(2) 12
(3) 20
(4) 26.6

40_____

41 Bow, cup, and twist are terms which describe types of

1 lumber decay
2 warped lumber
3 knotted lumber
4 lumber grades

41_____

42 When lumber can withstand a sudden shock load, it is said to have good

1 compression strength
2 hardness
3 toughness
4 elasticity

42_____

43 A piece of lumber that can carry a heavy load when it is placed in a horizontal position with the ends resting on two or more supports is considered to have

1 bending strength
2 compression strength
3 hardwood
4 toughness

43_____

44 The ability of lumber to resist being squeezed together is called

1 bending strength
2 toughness
3 hardness
4 compression strength

44_____

Unit D. Joinery (45-54)

45 Any glue, cement, or mucilage that bonds materials together is called

1 an adhesive
2 an epoxy
3 an abrasive
4 a contact

45_____

46 Which joint is often held together with corrugated fasteners?

1 dowel
2 edge to edge
3 mortise and tenon
4 miter

46_____

47 Which joint is used in quality drawer and box construction?

1 peg and dowel
2 miter
3 dovetail
4 spline

47_____

48 Which joint is often used in the leg and rail construction of chairs and tables?

1 dovetail
2 miter
3 mortise and tenon
4 lap

48_____

49 The easiest and simplest joint to use is a

1 butt
2 dado
3 miter
4 mortise and tenon

49_____

50 The best saw to use for cutting an angular joint is a

1 jigsaw
2 coping saw
3 miter saw
4 saber saw

50_____

51 When stock is glued edge to edge, a trace of light appears through the center of the joint being glued. What kind of a joint is this?

1 butt
2 dado
3 spring
4 rabbet

51_____

52 When gluing stock edge to edge, the clamps should be placed every

(1) 8 - 12 inches
(2) 15 - 18 inches
(3) 22 - 28 inches
(4) 30 - 36 inches

52_____

53 In industry, the time it takes for glue to dry can be decreased by using

1 low-frequency heat
2 hot presses
3 high-pressure presses
4 electronic curing

53_____

54 Dowel rods are usually made from

1 birch
2 cedar
3 oak
4 pine

54_____

Unit E. Fasteners (55-63)

55 Which type of bolt has a spring type head and is often used in concrete block walls?

1 carriage bolt
2 molly bolt
3 lag bolt
4 toggle bolt

55_____

56 Which type of screw is measured from the top of the head to the tip to determine its size?

1 roundhead wood screw
2 flathead wood screw
3 oval head wood screw
4 Phillips head wood screw

56_____

57 Board A is being fastened to board B with a wood screw. How much of the screw should enter board B?

1 one-quarter of the screw
2 one-third of the screw
3 one-half of the screw
4 two-thirds of the screw

57_____

58 A nail set is used to

1 drive nails below the surface of the wood
2 predrill a nail hole
3 start nails in hardwood
4 start nails in softwood

58_____

59 How many times the diameter of the head of a finishing nail should the nail be set below the surface of wood?

(1) 1
(2) 2
(3) 3
(4) 4

59_____

60 Which type of nail is most often used when constructing the frame of a house?

1 finishing
2 common
3 box
4 casing

60_____

61 Which type of nail often has a resin coating which produces a high withdrawal resistance?

1 finishing
2 common
3 box
4 casing

61_____

62 Toenailing should always be used when nailing

1 sheetrock
2 the bottom of a stud
3 underlayment
4 shingles

62_____

63 Which type of hammer is most often used to install nails?

1 wooden mallet
2 claw hammer
3 ball peen hammer
4 plastic hammer

63_____

Unit F. Mass Production (64-68)

64 The basic function of a fixture is to

1 assist in forming or cutting parts
2 provide a pattern for a specific shape
3 move parts in mass production
4 package the final product

64_____

65 The basic function of a template is to

1 move parts in mass production
2 hold parts in place during assembly
3 provide a pattern for a specific shape
4 package the final product

65_____

66 Which device is commonly used to make and measure interchangeable parts?

1 jig
2 fastener
3 clamp
4 gauge

66_____

67 The total time it takes to design, plan, and start a product in production manufacturing is called

1 starting time
2 research time
3 lead time
4 production time

67_____

68 The finishing solvent made from the resin of pine trees is called

1 alcohol
2 mineral spirits
3 turpentine
4 linseed oil

68_____

Unit G. Finishes (69-82)

69 Which material is a pure distillation of petroleum?

1 alcohol
2 linseed oil
3 turpentine
4 mineral spirits

69_____

70 The finishing material made from flax seed is called

1 alcohol
2 mineral spirits
3 linseed oil
4 turpentine

70_____

71 The solvent used for shellac is

1 alcohol
2 mineral spirits
3 lacquer thinner
4 turpentine

71_____

72 The three classifications of finishes are

1 transparent, opaque, and special effect
2 natural, transparent, and opaque
3 flat, gloss, and semigloss
4 oil, latex, and water base

72_____

73 What should be applied before stain is used on the end grain of a piece of wood?

1 shellac
2 linseed oil
3 lacquer
4 turpentine

73_____

74 When a workman is applying a quality finish, the final step after rubbing and polishing is

1 sealing
2 glazing
3 stripping
4 waxing

74_____

75 The process of adding a highlighted, shaded, or antiqued effect is called

1 blending
2 crazing
3 glazing
4 distressing

75_____

76 When cleaning a brush, a painter must know

1 what the finish looks like
2 the type of brush used
3 the drying time of the finish
4 the vehicle of the finish used

76_____

77 The markings "XXX" on a brush means that the

1 length of the bristles are three times the width of the brush, only
2 bristles are put up in three rows, only
3 length of the bristles is one-third the width of the brush
4 bristles are put in three rows and their length is three times the width of the brush

77_____

78 What grade of wet-dry abrasive paper should be used for wood finishing?

(1) A - D
(2) 80 - 120
(3) 240 - 400
(4) "XXX"

78_____

79 Excess paste filler should be removed by a coarse cloth or

1 burlap
2 a scraper
3 a tack cloth
4 turpentine

79_____

80 If a tack cloth is not tacky enough, it may be revived by

1 placing it in warm water
2 holding it in the hand
3 placing it in a solution of turpentine
4 placing it in a solution of mineral spirits

80_____

81 A tack cloth is used to

1 prepare a surface for finishing
2 pick up dust, lint, and sand particles from a surface
3 remove small imperfections and pencil marks
4 seal open grain wood

81_____

82 A varnish finish is affected more by dust particles than a lacquer finish because it

1 produces a harder surface
2 produces a softer surface
3 dries faster
4 dries slower

82_____

Unit H. Industrial Organization (83-87)

83 Which type of chart shows the steps to be followed in manufacturing a product?

1 operation flow chart
2 procedure chart
3 production flow chart
4 industrial manufacture chart

83_____

84 The process of getting the necessary machines and tools ready to start production of a product is called

1 automation
2 quality control
3 tooling up
4 time study

84_____

85 Which term describes the process of making things in large quantities?

1 quantity manufacture
2 industrial industrialization
3 industrial production
4 mass production

85_____

86 Which people determine how long it takes to do particular jobs in industry?

1 foremen
2 quality control workers
3 blue-collar workers
4 time study workers

86_____

87 The process of inspecting products to check the accuracy of the work is called

1 development
2 quantity control
3 quality control
4 research

87_____

Part II Housing

Unit A. Design and Planning (88-103)

88 Building codes have been established by many local governments to protect the

1 workers on the construction site
2 builder in charge
3 homeowner
4 building inspectors 88_____

89 The term prefabrication refers to

1 assembling parts or sections of a home before it is shipped to the site
2 assembling an entire structure on the site piece by piece
3 precutting the framing members before they are shipped to the site
4 building sections on the site, and then assembling them together 89_____

90 Which type of house framing is most often used in the United States today?

1 platform framing
2 balloon framing
3 plank-and-beam framing
4 braced framing 90_____

91 What is the most common method of house construction in the United States?

1 concrete block
2 brick
3 wood frame
4 veneer 91_____

92 The place where a building is to be built is called the

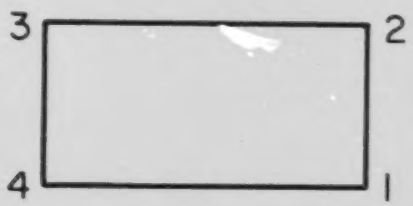
1 building block
2 building site
3 plot plan
4 building plan 92_____

93 After the plot markers have been established, batter boards are used to lay out and locate the

1 substructure and superstructure
2 lines for excavation, footers, and foundation walls
3 length, width, and elevation
4 building location

93_____

94 When laying out the site for the rectangular building shown below, at what point or points should batter boards be set up?



1 at the first corner, only
2 at corners 1 and 2, only
3 at corners 1 and 3, only
4 at all four corners

94_____

95 The footings for a foundation wall are usually

1 twice as wide and at least as thick as the foundation wall
2 twice as thick and at least as wide as the foundation wall
3 the same thickness and width as the foundation wall
4 twice as thick and twice as wide as the foundation wall

95_____

96 Which item would help to prevent a foundation wall from sliding off its footing?

1 a chine
2 a sole plate
3 a keyway
4 a batten

96_____

97 Bridging is used in a house frame to

1 brace the rafters
2 support loads over doors and windows
3 bridge across gaps in wall framing
4 brace and stiffen floor joists 97_____

98 Which roof pitch would form a 45° angle with a level line?

(1) 3/12 (3) 6/12
(2) 4/12 (4) 12/12 98_____

99 Measurements of a working drawing are usually placed so that they may be read from the

1 top and right
2 right and bottom
3 bottom and left
4 left and top 99_____

100 A drawing of a building has a scale of 1/4 in. = 1 ft. If a wall measures 4 in. on the drawing, its size in the building would be

(1) 1 ft. (3) 16 ft.
(2) 8 ft. (4) 4 ft. 100_____

101 When designing a home, the location of the bearing beam is usually determined by the

1 location of the partitions in the main floor
2 distance between the floor joists
3 thickness of the foundation wall
4 thickness of the subfloor 101_____

102 Which type of home has the main entrance between floor levels and stairways which go upward and downward from the entrance level?

(1) 1 1/2-story (3) ranch
(2) 2-story colonial (4) raised ranch 102_____

103 Which style of furniture has developed from the Old World, is small in size, and has graceful curves?

1 French Provincial
2 Early American
3 Mission
4 contemporary

103_____

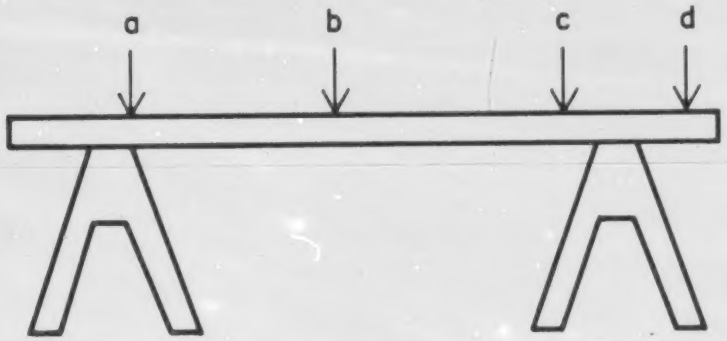
Unit B. Hand Tools and Portable Machines (104-114)

104 The size of a portable circular saw is determined by the

1 diameter of the blade
2 horsepower of the motor
3 length of the shoe plate
4 amperage of the motor

104_____

105 The diagram below shows a 2-x-4 on a set of sawhorses. Which would be the safest place to cut the 2-x-4 with a portable circular saw?



(1) a
(2) b
(3) c
(4) d

105_____

106 Which type of saw should be used to cut a pocket opening in a subfloor?

1 radial arm
2 table saw
3 bandsaw
4 portable circular saw

106_____

107 Which type of saw should be used to cut an opening in the center of a sheet of wall paneling for a convenience outlet?

1 hack
2 saber
3 coping
4 portable circular

107_____

108 The top of the arc of the knives of a jointer should always be level with the

1 fence
2 guard
3 infeed table
4 outfeed table

108_____

109 The size of a jointer is usually determined by the

1 length of the blades
2 length of the tables
3 weight of the base
4 horsepower of the motor

109_____

110 Which tool is most often used for laying out a sole plate for wall studs that are 16 inches on center?

(1) try square
(2) framing square
(3) level
(4) T-bevel

110_____

111 How long is the blade of a framing square?

(1) 12 in.
(2) 18 in.
(3) 24 in.
(4) 36 in.

111_____

112 When checking the top of a foundation wall to be sure that each corner is level with the other corners, the best instrument to use would be a

(1) transit
(2) framing square
(3) plumb bob
(4) 4-foot level

112_____

113 A gain should always be cut when installing

1 locksets
2 butt hinges
3 thresholds
4 stairways

113_____

114 The corner of the plane iron in a handplane is gouging the surface being planed. This problem can be corrected by adjusting the

1 plane iron cap
2 lateral adjusting lever
3 chip breaker
4 thumbscrew 114_____

Unit C. Lumber, Panels, and Boards (115-128)

115 Plywood is sold by the

1 square foot 3 linear foot
2 board foot 4 surface foot 115_____

116 Softwood lumber is usually sold in lengths of

(1) 6 in. (3) 18 in.
(2) 12 in. (4) 24 in. 116_____

117 Which is the poorest grade of softwood lumber?

(1) #1 common (3) d select
(2) #2 common (4) clear 117_____

118 Which type of lumber is usually the thickest?

1 boards 3 sheeting
2 planks 4 timbers 118_____

119 Which building material is often "tempered" by impregnating it with oils and resins that make it darker and more water resistant?

1 formica 3 paneling
2 hardboard 4 particle board 119_____

120 Moldings, baseboard, and trim are sold by the

1 square foot 3 linear foot
2 board foot 4 surface foot 120_____

121 Which grade of plywood would be most suitable for sheathing?

(1) A-A
(2) A-C
(3) A-D
(4) C-D

121_____

122 The horizontal members that support the floor of a house are called

1 joists
2 plates
3 rafters
4 studs

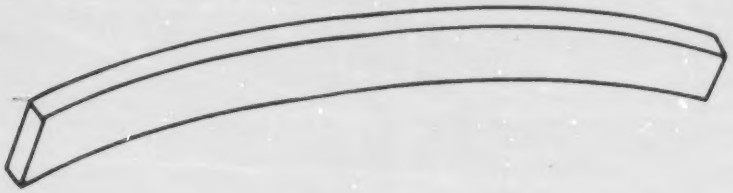
122_____

123 The vertical 2-x-4's in the walls of most houses are called

1 joists
2 plates
3 rafters
4 studs

123_____

124 The board in the drawing below has a warpage defect called a



1 bow
2 crook
3 twist
4 cup

124_____

125 Which thickness of plywood is usually used to make kitchen cabinet drawer bottoms?

(1) 1/4 in.
(2) 1/2 in.
(3) 5/8 in.
(4) 3/4 in.

125_____

126 The actual size of a dressed 2-x-4 would measure

(1) 2 in. by 4 in.
(2) $1\frac{5}{8}$ in. by $3\frac{5}{8}$ in.
(3) $1\frac{1}{2}$ in. by $3\frac{1}{2}$ in.
(4) $1\frac{1}{4}$ in. by $3\frac{1}{4}$ in.

126_____

127 Which building material is manufactured from wood flakes, chips, and shavings, and is usually sold in sheets?

1 formica
2 hardboard
3 paneling
4 particle board

127_____

128 A square of material will cover an area of

(1) 27 sq. ft.
(2) 32 sq. ft.
(3) 3 sq. ft.
(4) 100 sq. ft.

128_____

Unit D. Millwork and Hardware (129-141)

129 The trim just below the window stool is called the

1 apron
2 casement
3 stop
4 sill

129_____

130 What is the name of the trim around the inside of a window that covers the rough opening between the window and the finish wall?

1 apron
2 casing
3 stop
4 facing

130_____

131 Which piece of trim is placed beneath the sill of a window?

1 apron
2 casing
3 stop
4 sash

131_____

132 The pieces that hold a window sash in place are called

1 sills
2 sashes
3 stops
4 trims

132_____

133 Which type of joint is usually used to fasten window casings together at the corners?

1 dado
2 rabbet
3 lap
4 miter

133_____

134 Which type of door has a smooth, flat surface?

1 paneled
2 louvered
3 French
4 flush

134_____

135 Into which part of a paneled door should the lockset be installed?

1 stile
2 rail
3 panel
4 sill

135_____

136 When laying out for an interior door, what amount should be added to the door size to allow for the rough opening?

(1) 1 in.
(2) 2 in.
(3) 1½ in.
(4) 2½ in.

136_____

137 The doors of a kitchen cabinet are made of plywood. Which type of hinge should be used so that the screws can be driven into the face grain?

1 concealed pin
2 butt
3 semiconcealed
4 piano

137_____

138 In order for a door to fit properly, the sides of the doorjamb must be

1 square
2 level
3 plumb
4 tapered

138_____

139 The wood frame on which an interior door is hung is called the

1 jamb
2 mullion
3 casing
4 apron

139_____

140 Which type of window has a sash that is hinged on the side and swings out?

1 awning
2 casement
3 double hung
4 sliding

140_____

141 Which type of window is hinged on the top and swings out at the bottom?

1 awning
2 casement
3 double hung
4 sliding

141_____

Unit E. Reconstruction and Maintenance (142-156)

142 What is the standard height of kitchen counter tops from the floor?

(1) 30 in.
(2) 32 in.
(3) 34 in.
(4) 36 in.

142_____

143 Which type of joint is best for fastening the back of a cabinet drawer to the sides?

1 dado
2 rabbet
3 lap
4 miter

143_____

144 To which dimension of a new window should the wall studs be framed when replacing an old window unit with a new unit?

1 glass size
2 sash size
3 unit dimension
4 rough opening

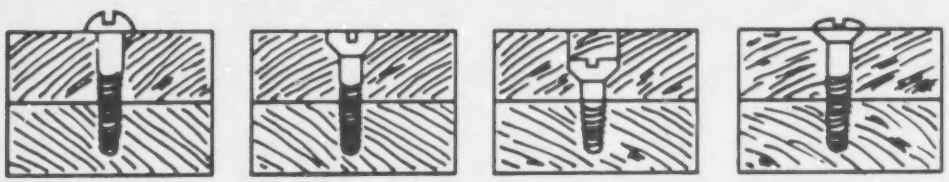
144_____

145 Which type of plate should be used when strengthening the corner of a wood screen door?

(1) laminating plate
(2) T-plate
(3) mending plate
(4) flat corner plate

145_____

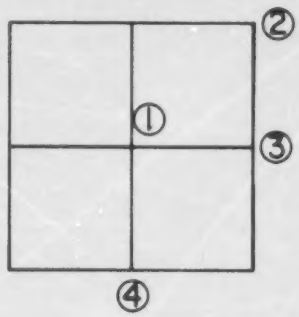
146 Which drawing shows a counterbored wood screw?



(1) (2) (3) (4)

146_____

147 The drawing below represents a kitchen floor. Which number indicates the place you should start when laying floor tile?



(1) 1
(2) 2
(3) 3
(4) 4

147_____

148 Which part of a wood floor is nailed directly to the floor joists?

1 subfloor
2 underlayment
3 finish floor
4 sleeper

148_____

149 Which material must be applied to raw oak wood before any finish is applied?

1 varnish
2 glaze
3 filler
4 paint

149_____

150 When heating a fitting in a pipeline of copper tubing, a person finds that the solder will not melt. This problem is most likely caused by

1 dirt covering the solder
2 water in the line
3 flux covering the solder
4 too much solder in the fitting

150_____

151 When constructing a house or an addition with a crawl space type of foundation, the footings must be constructed below the

1 frost line
2 building line
3 plumbline
4 gravel line

151_____

152 The base in most latex paints is

1 oil
2 alcohol
3 lacquer
4 water

152_____

153 Which paint problem is caused by too much moisture?

1 blistering
2 wrinkling
3 chalking
4 cracking

153_____

154 The primary function of paint is to

1 change the color of a building
2 hide defects in a building
3 keep excessive moisture out of wood
4 reflect heat rays

154_____

155 A good quality paint should wear away normally in a period of

(1) 3 - 4 years
(2) 4 - 6 years
(3) 6 - 8 years
(4) 8 - 10 years

155_____

156 The formula $\frac{T \times W \times L}{144}$ is used to compute the quantity of

1 linear feet
2 square feet
3 cubic feet
4 board feet

156_____

Unit F. Careers and Industry (157-160)

157 Which person is usually responsible to the owner for the construction of a home?

1 finish carpenter
2 laborer
3 contractor
4 excavator

157_____

158 Most of the work of a finish carpenter involves

1 hanging and trimming doors
2 building forms for concrete
3 framing
4 roofing

158_____

159 Which is an example of a fringe benefit?

1 unemployment insurance
2 social security
3 vacation pay
4 eight-hour workday

159_____

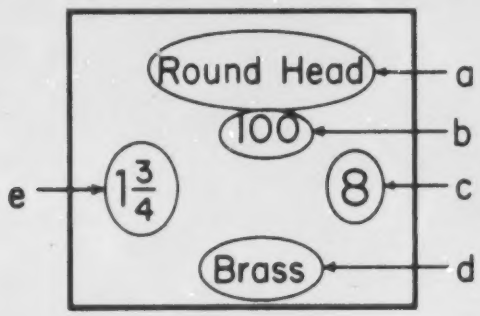
160 In the United States, the two main types of union structures are

1 crafts and hobbies
2 craft (trade) and industrial
3 group and individual
4 skilled and unskilled

160_____

Group Questions (161-176)

161 The top of a box of wood screws is shown below. For each of a through e in the diagram, write in the space provided the type of information that is indicated by that letter. [5]



a _____

b _____

c _____

d _____

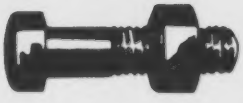
e _____

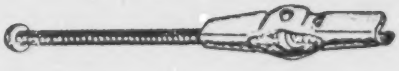
162 On the line at the left of each diagram in parts a through e, write the number of the type of fastener, chosen from the list below, that is shown in that diagram. [5]

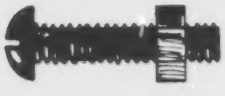
Fasteners

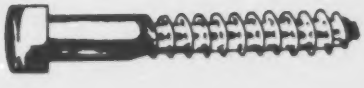
1 stove bolt
2 machine bolt
3 molly bolt
4 lag screw
5 spring bolt
6 toggle bolt
7 carriage bolt

____ (a)

____ (b) 

____ (c) 

____ (d) 

____ (e) 

163 On the line at the left of each word in parts a through e, write the number of the phrase, chosen from the list below, that best defines that word. [5]

Phrases

(1) a list of qualifications needed by an employee
(2) diagram of the path a product follows during production
(3) an organized way of thinking to solve a specific problem
(4) a device that determines the shape or design of a product
(5) information concerning the hiring of a person to fill a specific job
(6) device made for holding work or guiding a tool
(7) arrangement of materials, supplies, machinery, and personnel

____ a Research
____ b Jig
____ c Production line
____ d Flow chart
____ e Job specification

164 Directions: On the line at the left of each type of finish listed in parts a through e, write the number of the thinner, chosen from the list below, that would be used with that finish. (A number may be used more than once). [5]

Thinners

(1) Lacquer
(2) Turpentine
(3) Alcohol
(4) Water

____ a shellac
____ b varnish
____ c oil base paint
____ d lacquer
____ e latex paint

165 On the line at the left of each operation in parts a through e, write the number of the power tool, chosen from the list below, that would be used to perform that operation. [5]

Tools

(1) Jigsaw
(2) Lathe
(3) Planer
(4) Jointer
(5) Bandsaw
(6) Drill press
(7) Spindle sander

____ a reduces the thickness of a piece of stock
____ b squares an edge of a piece of stock
____ c cuts an inside circle out of a piece of stock
____ d cuts irregular curves of thick stock
____ e makes smooth inside curves

166 List the steps in determining the moisture content of a sample of wood using the oven dry method. [5]

1 _____

_____

2 _____

_____

3 _____

_____

4 _____

_____

167 List the four steps involved in laying out a common rafter. [5]

1 _____

_____

2 _____

_____

3 _____

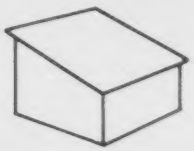
_____

4 _____

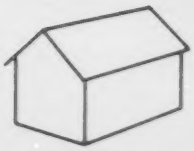
_____

168 Five common types of roofs are shown in parts a through e. On the line at the left of each diagram, identify the type of roof shown. [5]

_____ (a)

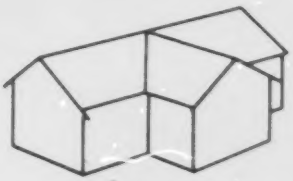


_____ (b)

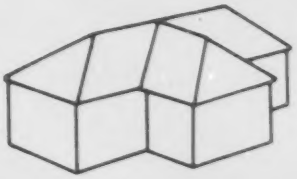


_____ (c)

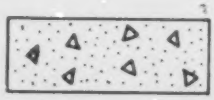
_____ (d)



_____ (e)

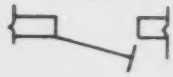


16º On the line at the left of <u>each</u> symbol in parts <u>a</u> through <u>j</u>, tell what that symbol represents. [5]

_____ (a) 

_____ (b)

_____ (c)

_____ (d) 

_____ (e)

_____ (f)

_____ (g)

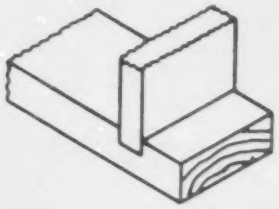
_____ (h)

_____ (i)

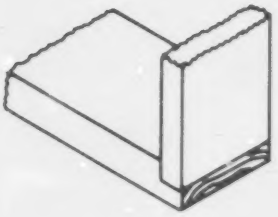
_____ (j) S_3

170 Five common types of joints are shown in parts a through e. On the line at the left of each diagram, identify the type of joint. [5]

_____ (a)

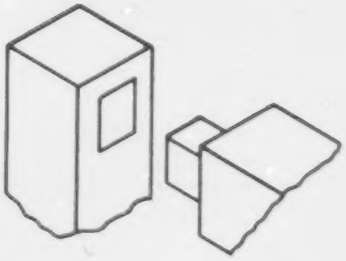


_____ (b)

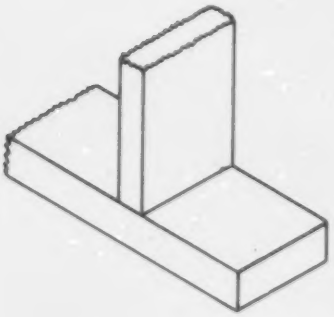


_____ (c)

_____ (d)



_____ (e)



171 On the line at the left of each hand tool in parts a through e, write the number of the phrase, chosen from the list below, that gives one use of that tool. [5]

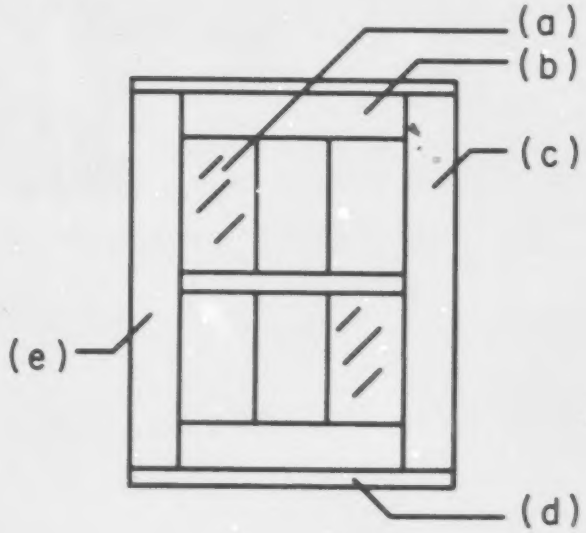
Uses

(1) Trimming laminates
(2) Cutting a hole for a lockset
(3) Cutting a hole in wall paneling for a convenience outlet
(4) Planing the edges of boards
(5) Cutting recesses for door hinges
(6) Trimming plywood on the edge of the roof
(7) Installing blanket insulation

Tools

____ a portable drill
____ b portable circular saw
____ c saber saw
____ d staple gun
____ e router

172 For each of parts a through e in the diagram below, write in the space provided the name of the part of the window that is indicated by that letter. [5]



a _____

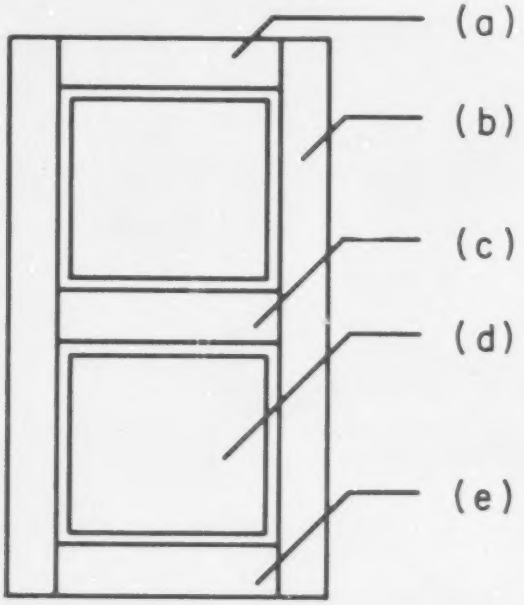
b _____

c _____

d _____

e _____

173 For each of parts a through e in the diagram below, write in the space provided the name of the part of the panel door construction that is indicated by that letter. [5]



a _____

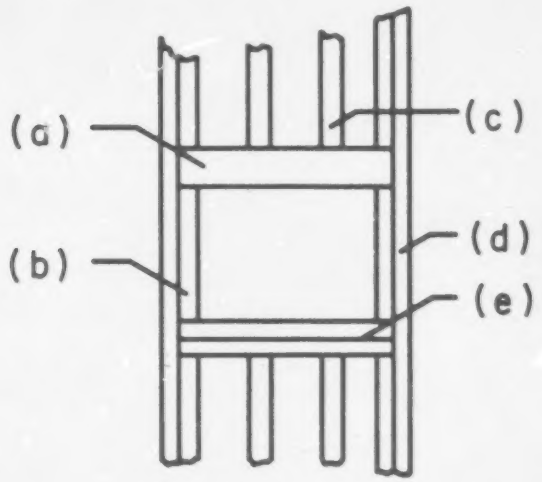
b _____

c _____

d _____

e _____

174 For each of parts a through e in the diagram below, write in the space provided the name of the part of the rough window opening that is indicated by that letter. [5]



a _____

b _____

c _____

d _____

e _____

175 Directions: On the line at the left of each type of design job listed in parts a through e, write the number of the type of designer, chosen from the list below, who would do that type of design. (A number may be used more than once.) [5]

Types of Designers

(1) Landscape designer
(2) Room designer
(3) Architect
(4) Structural designer

____ a designs the steel frame and wall units for buildings

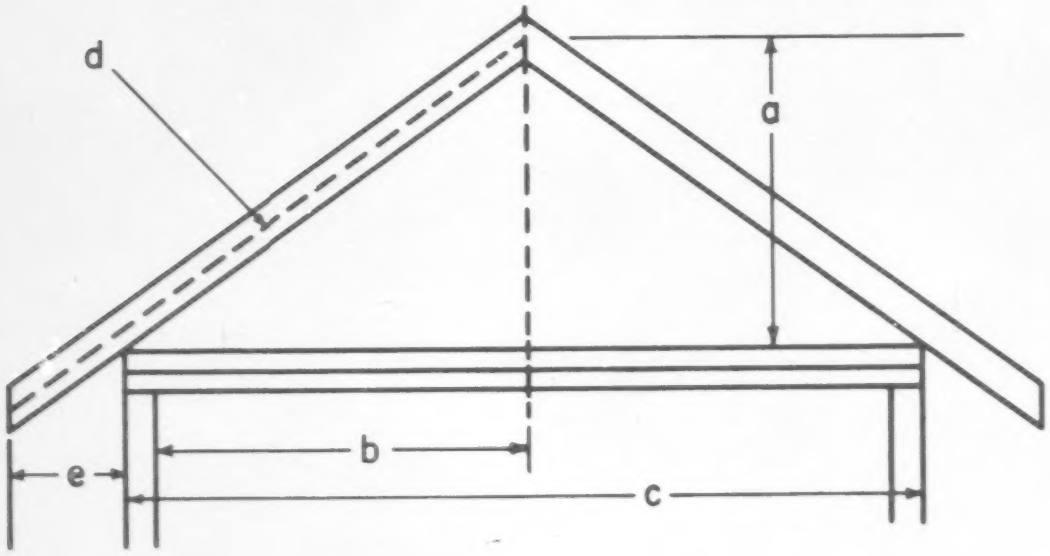
____ b designs how a site should be graded and the placement of trees and shrubs

____ c designs space allocations and the placement of partitions in buildings

____ d designs the exterior size and shape of buildings

____ e designs the building services such as electrical wiring and plumbing

176 On the line at the left of each of parts a through e, write the number of the roof part, chosen from the list below, which is indicated by each letter on the diagram below. [5]



Roof Parts

(1) Rise
(2) Overhang
(3) Run
(4) Span
(5) Joist
(6) Measuring line
(7) Stud

____ a
____ b
____ c
____ d
____ e

Industrial Arts Examination Materials

WOODS

Scoring Key

(1) 3	(31) 3	(61) 3	(91) 3	(121) 4	(151) 1
(2) 2	(32) 4	(62) 2	(92) 2	(122) 1	(152) 4
(3) 1	(33) 2	(63) 2	(93) 2	(123) 4	(153) 1
(4) 2	(34) 1	(64) 1	(94) 4	(124) 1	(154) 3
(5) 3	(35) 2	(65) 3	(95) 1	(125) 1	(155) 2
(6) 4	(36) 4	(66) 1	(96) 3	(126) 3	(156) 4
(7) 3	(37) 4	(67) 3	(97) 4	(127) 4	(157) 3
(8) 2	(38) 2	(68) 3	(98) 4	(128) 4	(158) 1
(9) 2	(39) 2	(69) 4	(99) 2	(129) 1	(159) 3
(10) 1	(40) 3	(70) 3	(100) 3	(130) 2	(160) 2
(11) 4	(41) 2	(71) 1	(101) 1	(131) 1	(161) a shape or type
(12) 2	(42) 3	(72) 1	(102) 4	(132) 3	b quantity
(13) 4	(43) 1	(73) 2	(103) 1	(133) 4	c shank (diameter)
(14) 2	(44) 4	(74) 4	(104) 1	(134) 1	d type of metal (material)
(15) 3	(45) 1	(75) 3	(105) 4	(135) 1	e length
(16) 2	(46) 4	(76) 4	(106) 4	(136) 4	(162) a 7
(17) 1	(47) 3	(77) 2	(107) 2	(137) 3	b 2
(18) 4	(48) 3	(78) 3	(108) 4	(138) 3	c 6
(19) 3	(49) 1	(79) 1	(109) 1	(139) 1	d 1
(20) 1	(50) 3	(80) 2	(110) 2	(140) 2	e 4
(21) 4	(51) 3	(81) 2	(111) 3	(141) 1	(163) a 3
(22) 2	(52) 2	(82) 4	(112) 1	(142) 4	b 6
(23) 3	(53) 4	(83) 3	(113) 2	(143) 2	c 7
(24) 2	(54) 1	(84) 3	(114) 2	(144) 4	d 2
(25) 4	(55) 4	(85) 4	(115) 1	(145) 4	e 5
(26) 1	(56) 2	(86) 4	(116) 4	(146) 3	(164) a 3
(27) 1	(57) 4	(87) 3	(117) 2	(147) 1	b 2
(28) 2	(58) 1	(88) 3	(118) 4	(148) 1	c 2
(29) 2	(59) 2	(89) 1	(119) 2	(149) 3	d 1
(30) 3	(60) 2	(90) 1	(120) 3	(150) 2	e 4
					(165) a 3
					b 4
					c 1
					d 5
					e 7

(166) 1 Weigh wood sample.
2 Heat sample until it loses no more weight.
3 Subtract lightest weight from starting weight.
4 $\frac{\text{answer from step 3}}{\text{oven cry weight}}$ = moisture content

(167) 1 Determine the rise per foot of run.
2 Lay out the measuring line on the rafter.
3 While holding the square with the rise on the tongue and 12 inch on the blade, step off the number of times equal to the number of feet of run.
4 Lay out the plumb cut and the seat cut.

(168) a shed
b gable
c hip
d gable and valley
e hip and valley

(169) a concrete
b blocks
c exterior or outside
d interior or inside
e double hung
f casement
g water closet
h lavatory or sink
i outlet
j 3-way switch

(170) a dado
b rabbet
c miter
d mortise and tenon
e butt

(171) a 2
b 6
c 3
d 7
e 5

(172) a lights
b header
c jamb
d sill
e jamb

(173) a top rail
b stile
c center rail
d panel
e bottom rail

(174) a header
b trimmer or jack stud
c short stud or cripple
d stud
e sill

(175) a 4
b 1
c 2
d 3
e 3

(176) a 1
b 3
c 4
d 6
e 2